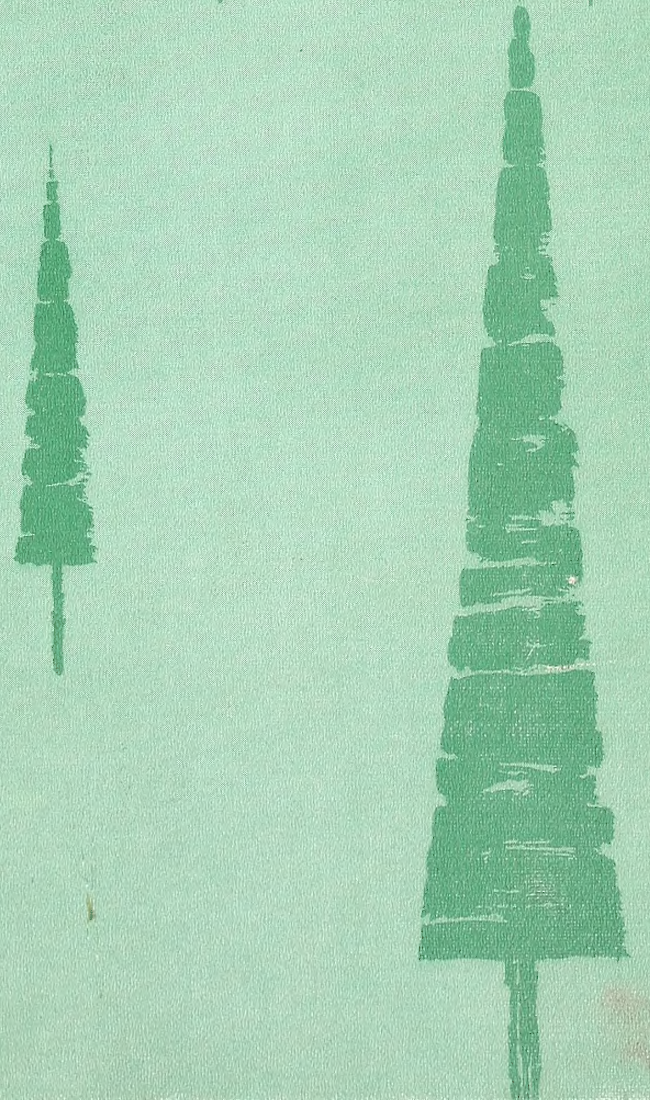
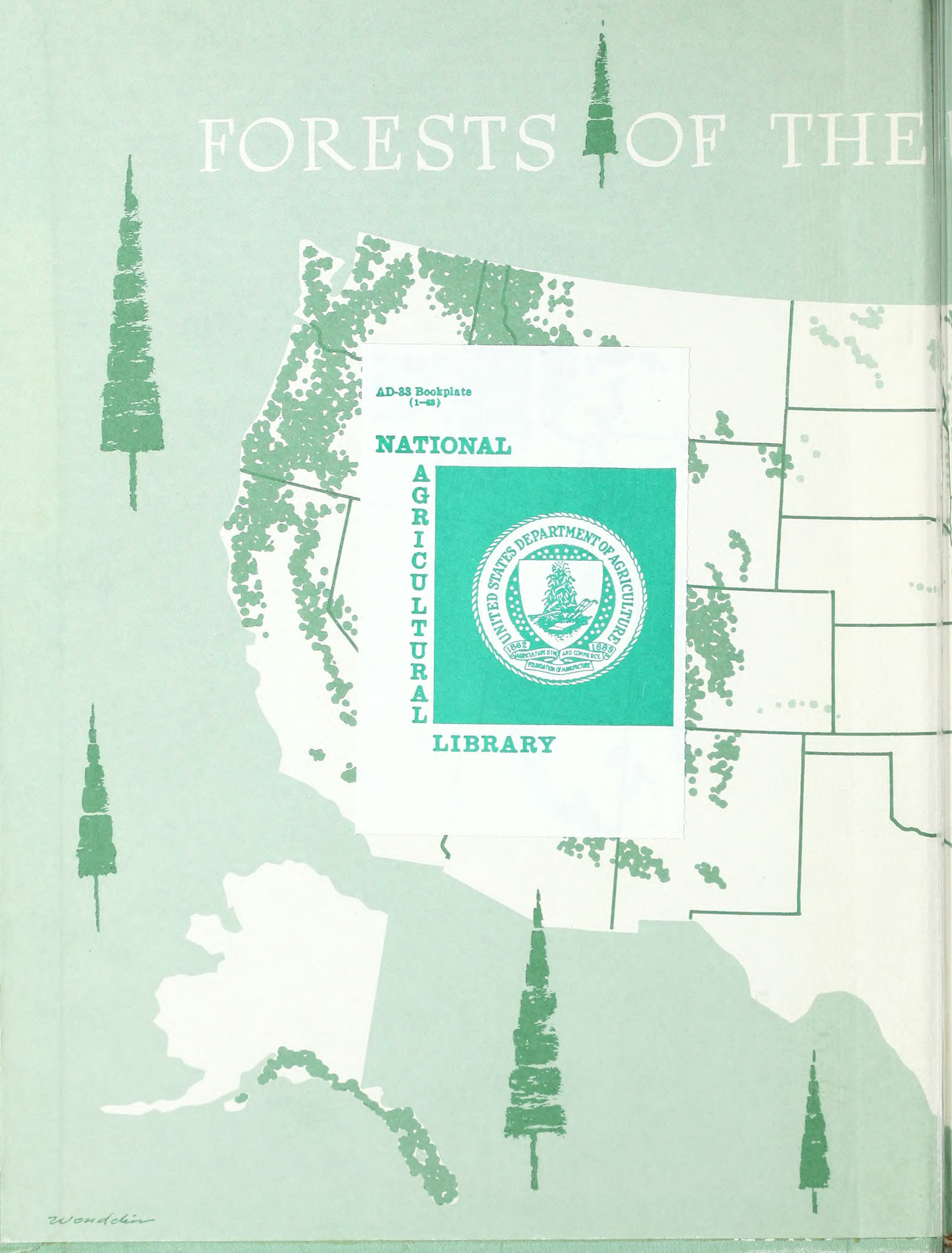
Timber Resources for America's Future



FOREST SERVICE

U. S. DEPARTMENT OF AGRICULTURE

Forest Resource Report No. 14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UNITED STATES

Timber Resources for America's Future

FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE
Forest Resource Report No. 14
January 1958

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FOREWORD

Tomorrow the Nation's need for timber will be strikingly greater than today or at any time in the past. We have the potential to meet that need if we fully apply our forestry knowledge and skills promptly, with vigor and determination.

That, in brief, is the essence of our findings in this comprehensive appraisal of the timber situation in the United States. The appraisal was started by the Forest Service in 1952, released in preliminary form in 1955, and has now been revised for final release.

Periodically the Forest Service has examined the forest situation as part of its overall responsibility to keep the people and the Congress informed as to timber supplies and outlook. This Timber Resource Review is the sixth of these "State-of-the-Union" reports on timber—one of the Nation's most important renewable natural resources. As was true of each of its predecessors, this report is more reliable and more comprehensive than any of its forerunners, because of improved technical skills and the availability of more information.

Although the natural resources of the United States have received much study in recent years by various commissions, States, the Congress, educational institutions, and others, there has been no assembly of new timber resource information for the entire country since the appraisals made by the Forest Service and the American Forestry Association in 1945. Since then, more and better timber inventory information has become available; there has been a decade of timber cutting and growth; and impressive strides have been made in forestry and in wood utilization. Since the 1945 appraisals the outlook for the future economy of the United States has changed greatly, particularly with respect to population. These and other changes made a new report timely.

The Timber Resource Review project was directed by Edward C. Crafts, Assistant Chief of the Forest Service in charge of program planning and legislation. The planning and field surveys in connection with this study were carried out with the advice and assistance of a great many organizations and individuals, especially the State Departments of Conservation or Forestry and forest industries. Because of this collaboration, the study was better conceived, more complete, and more soundly executed. The Forest Service, however,

accepts full responsibility for the factual data and the views expressed in the report.

In October 1955, a preliminary review draft was released. That draft was intended originally for in-Service review and for our advisers and collaborators. The demand was so great and interest so intense that the review draft had to be rerun several times and, all together, 15,000 copies of the Summary chapter of the review draft, 13,500 of the Statistical Appendix, and about 5,000 of the other chapters were processed.

The purpose of the preliminary draft was to invite review and comment. Some 2,000 suggestions were received from many individuals both in and out of the Forest Service. Each of these suggestions has been carefully considered; none was ignored. A great many were accepted. This final report is substantially different from the review draft and, we hope, better.

We hope that this study will add to America's leadership in forestry, that it will be useful to other nations of the world in relating their timber situation to ours, and that it will serve as a basis for long-range forestry planning for progressive forest landowners and for State and Federal Governments.

The report should convince the reader that the United States is not faced with an acute timber shortage. There is no "timber famine" in the offing although shortages of varying kinds and degrees may be expected. But it is equally clear that there is little danger of timber becoming a surplus crop. To meet future timber demands will take earnest effort. Meeting those needs will require not only early action but an intensity of forestry practices that will startle many of us. There are no grounds for complacency. What we do in the next 10 or 20 years will determine whether we shall grow enough timber to enable our children and their children to enjoy the timber abundance that we ourselves know.

Richard E. McArdle

RICHARD E. MCARDLE,
Chief, Forest Service.

ACKNOWLEDGMENT

This review of the Nation's timber resources was made by the Forest Service with the help of a great many experts in State and private forestry agencies, forest industries, conservation organizations, and other agencies in the Federal Government. The participation of these collaborators is described in the first part of the report. Their advice in planning the project, participation in the advisory group, and their assistance in assembling the facts of the timber situation are gratefully acknowledged.

Appreciation is also expressed to the many professional people in the Forest Service who participated in the Timber Resource Review. In addition to those named as authors in the separate sections of this report, a large number of others on the national forests, in research centers, in regional offices and experiment stations, and in the Chief's office, took part in planning the review, collecting and compiling field data, preparing preliminary analyses and interpretations, and reviewing the preliminary report. Because so many helped as part of their regular work and because individual efforts and responsibilities varied so widely, it is not possible to list all who deserve credit. The authors are indebted to the statistical clerks who tabulated and checked the data, and to the editors, secretaries, and draftsmen whose assistance in completing the manuscripts was invaluable. The comments on the preliminary draft of the many reviewers, both in and out of the Forest Service, have contributed much toward the final report.

Special mention should be made of Leonard I. Barrett, George F. Burks, James C. Rettie, John R. McGuire, and S. Blair Hutchison.

Edward C. Crafts

EDWARD C. CRAFTS,
Assistant Chief, Forest Service.

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TIMBER RESOURCES FOR AMERICA'S FUTURE

A Summary of the Timber Resource Review

Edward C. Crafts

INTRODUCTION

The report of the Timber Resource Review is in the nature of a "State-of-the-Union" message by the Forest Service on our national timber supplies. This comprehensive appraisal of the timber situation in the United States was started early in 1952. About a year and a half was devoted to planning the project; a year to field surveys and collection of data; a year to compilation, interpretation, and preparation of the preliminary report; and another year and a half to review and revision of the preliminary report and preparation of this final report.

The Timber Resource Review is the latest in a series of overall timber appraisals in which the Forest Service has shared. The most recent one prior to this study was in 1945. One of the unique features of the present undertaking is that it was planned and executed in the field with the widespread collaboration of a great number of States, forest industries, and individuals. Although this has engendered some delays, they have been more than offset by better planning, by more intensive surveys than the Forest Service could have undertaken by itself, and it is hoped by more widespread understanding and acceptance of the findings.

Purpose and Scope

The chief purpose of the Timber Resource Review is to provide a stock-taking of the current timber situation in the United States and a look into the future with respect to prospective timber supplies and needs. Because forestry is a long-time undertaking, the current situation in timber carries perhaps more than the usual implications as to future supplies. The basic facts on forest land areas, timber volumes, growth and utilization, timber quality, forest protection, forest ownership, productivity of land, prospective demand, and related information are essential tools in the formation of forest policy on a national, State, and local basis by both public and private institutions.

In part, the Timber Resource Review may be construed as discharging some of the responsibility delegated by the Congress to the Secretary of Agriculture in connection with the nationwide Forest Survey. The Congress has directed the Secretary, under such plans as he determines to be fair and equitable, to cooperate with the appropriate officials of each State, and either through them or directly with private and other agencies to make a comprehensive survey of the present and prospective requirements for timber and other forest products in the United States, and of timber supplies, including a determination of present and potential productivity of forest land. He is also directed to obtain such other facts as may be necessary in the determination of ways and means to balance the timber budget of the United States.[1] The Secretary is also directed to acquire and diffuse among the people of the United States useful information on subjects connected with agriculture in the most general and comprehensive sense of that word.[2]

Since its inception the Forest Service has felt the Timber Resource Review to be a timely undertaking. It believes that not only the significance of the facts that are subsequently presented but also the outlook for the future support that view.

Among the reasons for undertaking the Timber Resource Review in 1952 were the following: (1) The availability of new postwar information from the nationwide forest survey on forest areas, timber volumes, and growth on about half of the Nation's forest land. This information shows substantial changes and yet the rate of progress of this survey for the remainder of the country

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[1] McSweeney-McNary Forest Research Act of May 22, 1928, as amended (16 U. S. C. 581a–i).

[2] Department of Agriculture Organic Act, May 15, 1862 5 U. S. C. 511).

was such that to postpone appraising the national picture for a considerable additional period was deemed inadvisable. (2) Changes, both currently and prospectively, with respect to our national economic setting in terms of such overall criteria as trends in population and gross national product. These and related factors placed completely new orientation on prospective needs for timber products. (3) The post-World War II period appeared to mark a rapid acceleration in American forestry. Thousands of private forest owners showed heightened interest in timber growing. There was fuller utilization of the timber harvest. New gains were achieved in forest protection. The impact of these and other changes in the national forestry effort pointed toward a new look at the timber situation. (4) The international situation indicated that United States resources, particularly in softwoods, needed to be considered in relation to those of the free world rather than the entire world.

At the outset it is well to clarify the scope of the Timber Resource Review with respect to exclusions as well as inclusions. The report is in 11 main parts, the first of which is an overall summary, and the last of which is a series of appendices. The summary does not attempt to cover the entire array of statistical information assembled in this report. It is more in the nature of an analytical appraisal of the major findings which, in the course of their presentation, require summarization of a significant amount of factual material.

In the appendix, where the basic statistics are presented in greater detail than in any other section, there is more information available on a State basis than was possible to present in the more generalized discussion. The presentation of new data by States is one of the unique features of the Timber Resource Review that distinguishes it from its predecessors. Another is the degree of collaboration in both the planning and execution with States and forest industries.

Not all information in the Timber Resource Review is of equal reliability. The adequacy of of the different kinds of data is discussed in detail in the appendix.

The Timber Resource Review is an appraisal of the timber situation as distinguished from the forest situation. In other words, the orientation of this study has been with respect to timber supplies and needs in the Nation's economy. Not considered in this report is the utility of our forest resources for watershed management, grazing of domestic livestock, recreation, wildlife, or other purposes. The multiple-use values of forest stands, which in numerous instances transcend the utilitarian timber values, have not been appraised.

The Timber Resource Review is not a duplication of the appraisal made by the Forest Service and the American Forestry Association in 1945. It differs in scope, definitions, utilization standards, methodology, and other ways. Coastal Alaska is included as an integral part of the United States. At the outset there arose the question whether to duplicate the 1945 appraisal and thus obtain more direct comparisons and better trends, or whether to change procedures, definitions, and other details in order to provide a better survey and thus sacrifice some comparability. The latter was the course chosen.

The Timber Resource Review does not offer recommendations nor a program for American forestry. It does provide the base for program formation and an opportunity to both public and private groups to reconsider certain basic forestry policies and programs. The Forest Service believes that any program for American forestry which might evolve from the Timber Resource Review, by either the legislative or executive branches of the Federal Government, State groups, or private groups, will be more soundly conceived if it is predicated on review and discussion of the results of this study by all interested citizens.

PROCEDURES AND COLLABORATION

Procedures

Completion of the Timber Resource Review has involved five principal phases: (a) Planning, (b) field surveys and assembly of data, (c) data compilation and interpretation, (d) preparation of preliminary report, and (e) review and revision of preliminary report.

The planning phase, particularly, was characterized by a great deal of group and individual consultation. An informal national advisory group consisting of the following organizations was established:

American Farm Bureau Federation
American Federation of Labor
American Forestry Association
American Paper & Pulp Association
American Pulpwood Association
Association of State Foresters
Congress of Industrial Organizations
Council of Forestry School Executives
Farmers Union of America
National Grange
National Lumber Manufacturers Association
Natural Resources Council of America
Society of American Foresters

Some of these agencies participated much more actively than others in the three advisory group meetings which were held in April 1952, January 1953, and April 1956. In addition, representatives of the Departments of the Interior and Commerce participated in one or more of these meetings and were most helpful.

Following the first meeting of the advisory group, a smaller working group was named to collaborate with the Forest Service in preparing its working plans. After a meeting with the working group, preliminary working plans were developed and distributed for review purposes to key individuals throughout the country. Many discussions with regional and State groups were held concerning these plans, and there were four general area meetings in Atlanta, Milwaukee, San Francisco, and Philadelphia, at which these preliminary working plans were reviewed in detail. Additional comment was received from many individuals. The preliminary plans were substantially revised as a result of this widespread review and the discussion at a second meeting of the advisory group, held in January 1953. Following this meeting the final working plan was developed, and completed in the summer of 1953. These working plans are available for reference in the Forest Service Washington and regional offices and experiment station headquarters. Thus about one and a half years were devoted to the planning phase of the Timber Resource Review. By this procedure, plans for the project were greatly strengthened and the basis was laid for effective collaboration in the field surveys.

The field surveys and assembly of data occupied about a year and consisted of five principal activities: (a) timber inventory and growth surveys, (b) utilization surveys, (c) productivity survey, (d) assembly of other resource data, and (e) demand and growth projections.

The inventory and growth surveys were conducted under the leadership of the Forest Service regional forest experiment stations and involved three classes of work. First, there were 23 States in which the forest survey had been completed since January 1, 1947. For these the survey findings were accepted without additional fieldwork, and were adjusted by simple bookkeeping to January 1, 1953. Second, there were 10 States in which forest survey fieldwork was in progress and which were judged to be sufficiently advanced to furnish a base for extension to the remainder of those States with some supplementary field observations. Third, there were 15 States and Coastal Alaska in which it was necessary to conduct special surveys to obtain reasonably reliable estimates of the current resource situation.

In the utilization surveys, data were developed by the forest experiment stations usually in cooperation with the States. State cooperation was especially widespread in the Northeast. Although Bureau of Census data on output of lumber, veneer logs and bolts, and pulpwood were used as the overall control, supplementary surveys of varying intensity were made to obtain reliable estimates by States and geographic source of logs and bolts. Field surveys were also made as a basis for estimating the output of other timber products and the quantity and use of plant residues.

Productivity surveys were limited to an examination of recently cut commercial forest lands. These lands were examined according to a predetermined system and criteria which were developed locally in collaboration with State foresters and others. The statistical control for the productivity surveys was intended to provide reasonably reliable data on a regional basis, although in some instances it was intensified as the result of collaboration by State agencies to provide reliable data on a State basis.

There was a great deal of additional resource information assembled on protection, planting, and ownership. This information was not derived from new and original surveys but from reports available to the Forest Service or to State foresters, and through consultation and other sources.

The information on factors influencing past consumption of timber products and future demand for timber was based in part on field surveys, such as that conducted by the Forest Service for 1948 on wood used in manufacture, and to a great extent on economic and statistical reports of various Federal and State agencies, particularly the Departments of Labor and Commerce. The recent work of the Stanford Research Institute provided helpful guides in the field of timber requirements.

Inventory estimates for Interior Alaska were developed in collaboration with the Department of the Interior. Those for Canada were based largely on reports of the Dominion and Provincial Governments of Canada. Those for Mexico were based on a variety of sources, and those for other nations of the world on reports made by the various countries to the Food and Agriculture Organization of the United Nations.

In October 1955, a preliminary review draft consisting of 9 chapters was issued. This draft was intended originally for in-Service review, and for a key group of advisers, collaborators, public officials, and legislators. After issuance, however, the demand became so great that it soon was apparent that distribution could not be effectively restricted.

A 5-month review period ending in March 1956 was announced after issuance of the preliminary draft. Careful review was made of the report by all Forest Service regional offices and experiment stations and the Forest Products Laboratory. Comment and suggestions were invited from member organizations of the advisory group, Federal Departments and States, and all groups and individuals who cared to volunteer suggestions.

The Forest Industries Council volunteered a detailed review. The Department of the Interior offered constructive comment, as did various conservation and other groups. In all, some 2,000 individual suggestions were received.

In addition to the comments volunteered from outside the Forest Service and those requested from within Service, the Forest Service retained three men of national reputation to review parts or all of the preliminary report. These were: Dr. John D. Black, Henry Lee Professor of Economics, Emeritus, Harvard University; Dr. Samuel T. Dana, Professor Emeritus of Forestry, and Dean Emeritus, School of Natural Resources, University of Michigan; and Dr. Arnold C. Harberger, Associate Professor of Economics, University of Chicago.

The suggestions received were of great variety. A few were major, most were minor, and there were many duplications. All suggestions were carefully considered and about 50 percent accepted. In addition, there were many other changes made by the authors. The final report, although following somewhat the same general organizational pattern as the preliminary draft, is substantially a different document in many respects.

In preparing the final report, no attempt was made to bring the information presented in the preliminary draft up to date. To do this would have required new field surveys and would have been impractical. In general, the time period with which the report deals is 1952–53. There is some variation in this depending upon the types of data, and these are explained in the individual sections.

Collaboration

The very significant assistance received by the Forest Service from various sources has been mentioned already. Without such assistance, completion of the Timber Resource Review would not have been practicable.

The advice and counsel of the national advisory group was of real value. Also of great value was the basic information made available by State agencies and forest industries on such items as timber products output and forest fire experience. Valuable time and effort were contributed by a great many people in discussions throughout the country, at meetings, and in other ways in counseling during the planning phase of the Timber Resource Review. Much was also contributed in reviewing the preliminary report.

In addition to such help, there have been tangible contributions to the field execution of certain phases of the project, such as the field surveys in utilization, in timber inventory, and in productivity of recently cut lands. Valued at more than half a million dollars, these outside contributions consisted roughly of 78 percent manpower,[3] 13 percent facilities and equipment, and 9 percent cash. They came from the following sources:

[3] Valued at $500 per man-month.

Tasks	States	Forest industries [1]	Other Federal agencies [2]	Total
Timber utilization	$18,900	$500	$100	$19,500
Timber resource inventory	160,100	92,600	2,300	255,000
Productivity of recently cut lands	168,700	23,900	25,700	218,300
Other tasks [3]	6,800	-------	5,800	12,600
All tasks	354,500	117,000	33,900	505,400

[1] Including consulting and other privately employed foresters.

[2] Including also a small amount of contributions not elsewhere classified.

[3] Mainly forest protection and planting.

The most significant contributions were made by State agencies and totaled 70 percent of all assistance. State assistance was about equally divided between the inventory and productivity tasks, and was made by 65 State agencies in 37 States, including 36 State Departments of Forestry or Conservation, Extension Services in 12 States, 2 State Agricultural Experiment Stations, 10 State-supported educational institutions, and 5 other State agencies.

Forest industry contributed about 25 percent of total assistance. Industry's greatest contribution was to the inventory phase, although significant help also was made available in the productivity survey. A total of 149 forest industry sources assisted in the Timber Resource Review, of which 40 percent were lumber companies, 25 percent pulp and paper companies and the balance about equally divided between other wood-manufacturing companies and industry trade associations, consulting and other privately employed foresters. Industry also gave the review draft careful scrutiny and made numerous suggestions.

Principal assistance from other Federal agencies was from the Bureau of Land Management, Bureau of Indian Affairs, and National Park Service, Department of the Interior; Soil Conservation Service, Department of Agriculture; and Department of the Army.

Not included in the above summary was the cooperation extended by countless landowners in permitting access to their properties in connection with either the inventory or productivity field surveys. With very few exceptions, such access was wholeheartedly given. Also not included is the time and effort spent by the many reviewers.

It should be emphasized that the compilation of data, their interpretation and the report preparation are that of the Forest Service. Collaboration on the Timber Resource Review in any way, either through service on one of the advisory groups, through positive assistance as reflected in the preceding tabulation, through review of the first draft, or through merely giving access to one's property or individual production records, in no

way commits the collaborators or reviewers to support either the statistical or interpretative results of this report.

It should also be emphasized that information obtained in connection with the Timber Resource Review by the Forest Service on individual properties or individual output records is considered and treated in the same confidential manner as are statistics made available to the Bureau of the Census. Information on individual properties is utilized within the Forest Service only for Timber Resource Review purposes, and is available only to a small group of individuals working on the Timber Resource Review project. No information relative to individual enterprises has been or will be released except: (1) To a participating public agency whose authorized employee collected the information in question—this is done on the basis that presumably the agency will already have that information from field forms completed by its employee; and (2) upon the written consent or request of the individual whose property is involved.

Earlier Reviews of the Timber Situation

Most of the earlier national reviews were prepared either by the Forest Service or other Executive Branch agencies, by governmental boards or commissions, or by committees of the Congress. Following is a list of the principal reports on our timber situation which might well be considered as predecessors to the present report, beginning with a report by the Department of Agriculture in 1909 on "The Timber Supply of the United States." This comprehensive list is included because a number of these reports have tended to be forgotten with the passage of time.

1909 (1909)[4] Kellogg, R. S. *The Timber Supply of the United States.* U. S. Dept. Agr. Forest Serv. Cir. 166. 24 pp., illus.

1911 (1911) U. S. Dept. Commerce and Labor, Bur. Corps. *Summary of Report of the Commissioner of Corporations on the Lumber Industry, Pt. 1, Standing Timber.* 38 pp., illus. [The "Bureau of Corporations Report."]

Part I, Standing Timber [including summary]. 301 pp., illus. (1913.)

Part II, Concentration of Timber Ownership in Important Selected Regions. (1914.)

Part III, Land Holdings of Large Timber Owners [with ownership maps]. 264 pp., illus. (1914.)

1920 (1920) U. S. Dept. Agr., Forest Service. *Timber Depletion, Lumber Prices, Lumber Exports, and Concentration of Timber Ownership.* Rpt. on Sen. Res. 311, 66th Cong., 2d sess. 71 pp., illus. [The "Capper Report."]

1923 (1920) Greeley, W. B., Clapp, E. H., *et al.* *Timber: Mine or Crop?* U. S. Dept. Agr. Yearbook 1922: 83–180, illus.

1924 (1922) Clapp, Earle H., and Boyce, Charles W. *How the United States Can Meet Its Present and Future Pulpwood Requirements.* U. S. Dept. Agr. Dept. Bul. 1241, 100 pp., illus. [The "Clapp-Boyce Report."]

1932 (1930) U. S. Dept. Agr., Forest Service. *The Forest Situation in the United States (A Special Report to the Timber Conservation Board).* 46 pp., illus. [Processed.]

1933 (1930) U. S. Dept. Agr., Forest Service. *A National Plan for American Forestry.* Sen. Doc. 12, 73d Cong., 1st sess. 2v., 1,677 pp., illus. [The "Copeland Report."]

1934 (1930) National Resources Board Report. *Forest Land Requirements and Available Resources.* Pp. 135–143, illus. *Forest Land Problems and Policies.* Pp. 207–216, illus.

1935 (1930) U. S. Dept. Agr., Forest Service. *Forest Land Resources, Requirements, Problems, and Policy.* Pt. VIII, Supplementary Report of the Land Planning Committee to the National Resources Board, 114 pp., illus.

1935 (1930) Curran, C. E., and Behre, C. E. *National Pulp and Paper Requirements in Relation to Forest Conservation.* Sen. Doc. 115, 74th Cong., 1st sess. 74 pp., illus. [The "Hale Report."]

1939 (1938) U. S. Dept. Agr., Forest Service. *A National Forest Economy: One Means to Social and Economic Rehabilitation.* 296 pp., illus. [Processed.]

1940 (1938) Marsh, R. E., and Gibbons, W. H. *Forest Resource Conservation.* U. S. Dept. Agr. Yearbook 1940: 458–488, illus.

1941 (1938) U. S. Cong. Joint Committee on Forestry. *Forest Lands of the United States.* Sen. Doc. 32, 77th Cong., 1st sess. 44 pp., illus. [The "J. C. Report."]

1948 (1945) U. S. Forest Service. *Forests and National Prosperity.* U. S. Dept. Agr. Misc. Pub. 668, 99 pp., illus. [The "Reappraisal Report."]

Report 1. *Gaging the Timber Resource.* 62 pp., illus. 1946; rev. 1947. [Processed.]

Report 2. *Potential Requirements for Timber Products.* 70 pp., illus. 1946; rev. 1947. [Processed.]

Report 3. *The Management Status of Forest Lands.* 29 pp., illus. 1946; rev. 1947. [Processed.]

Report 4. *Wood Waste.* 45 pp., illus. 1947. [Processed.]

Report 5. *Protection Against Forest Insects and Diseases.* 39 pp., illus. 1947; rev. 1948. [Processed.]

Report 6. *Forest Cooperatives.* 18 pp. 1947. [Processed.]

1952 (1945) President's Materials Policy Commission. *Making the Most of Timber Resources.* *In* Resources for Freedom, v. 1, pp. 36–45.

1952 (1945) U. S. Dept. Agr., Forest Service *Domestic Timber Resources.* Rpt. 5 in v. V, Resources for Freedom, President's Materials Policy Commission.

Only a few of the above-listed reports were based upon new field data—the others were based largely upon reanalysis, restatement, and reemphasis of data previously published. The four reports which are most noteworthy from the standpoint of incorporating new data and thus being milestones in appraising our timber supply are the so-called "Capper Report" for 1920, "Copeland Report" for 1930, the report on "Resource Conservation" for 1938, and the "Reappraisal Report" for 1945. The Timber Resource Review falls in that category and incorporates the first new timber resource information reported by the Federal Government since the 1945 Reappraisal. The Forest Service considers the periodic preparation of these overall national appraisals as part of its regular work and continuing responsibility.

[4] Dates in parentheses are years to which data are applicable.

In addition to the Federal reports listed above, there have been significant contributions to our knowledge of the timber situation and demand for timber, prepared under the auspices of research institutions or conservation groups. The most notable of these is the "Report of the Forest Resource Appraisal," prepared by the American Forestry Association. This was an appraisal of the timber situation, based upon field surveys made at the same time as the 1945 Reappraisal of the Forest Service. There was cooperation between the two surveys and remarkable agreement as to the resource facts. Subsequently the American Forestry Association reported on the "Progress of Forestry," and more recently the Stanford Research Institute has completed a careful study of "America's Demand for Wood." Following are these three reports:

1946 Woods, J. B. *Report of the Forest Resource Appraisal.* American Forests 52: 413–28. [Reports for many individual States appeared in American Forests, 1945–49.]

1951 American Forestry Association. *The Progress of Forestry, 1945 to 1950.* 90 pp., illus.

1954 Stanford Research Institute. *America's Demand for Wood. 1929–1975.* A Report to Weyerhaeuser Timber Company. 404 pp., illus. Summary 94 pp., illus.

There are many other reports relating to forest policy, organization of forestry agencies, reports on individual States or parts of States. But it is believed the above two lists incorporate the principal national reports on timber inventories and demand.

Geographic Groupings

The Timber Resource Review is primarily a national appraisal. However, much of the information on the present timber situation is presented on a sectional, regional, or State basis where appropriate. The State is the smallest unit used and one region, the Pacific Northwest, is divided into two subregions.

There are three sections—North, South, and West—and 13 regions including Coastal Alaska (fig. 1).

Figure 1

In the continental United States, regional boundaries are the same as those used in the 1945 Reappraisal Report in order to facilitate comparison. The regional boundaries follow State lines with two exceptions: (1) The boundary between the Plains and West Gulf Regions in Oklahoma and Texas follows county lines in order to place the main timbered areas of eastern Oklahoma and Texas with the West Gulf Region; (2) county lines are followed between the Northern Rocky Mountain and Plains Region in part of South Dakota in order to place the Black Hills area in the Northern Rocky Mountain Region.

In grouping regions into sections, there was a choice of placing the Plains Region in the North, in the South, or breaking the region. Because about 80 percent of both the commercial forest area and timber volumes in the Plains Region lies north of the Oklahoma-Kansas line, the entire Plains Region is placed in the North.

For the first time, Coastal Alaska is treated as a separate region and with the same detail as other regions. Coastal Alaska includes the southeastern panhandle of Alaska and a narrow coastal strip and offshore islands extending westward to Cook Inlet and including Kenai Peninsula and Kodiak and Afognak Islands.

A FAVORABLE NATIONAL SETTING

In any attempt to appraise timber resources for the future, some assumptions as to future conditions must be made. For example, estimates of prospective demand for timber products cannot be developed except within the framework of certain economic assumptions, nor can prospective supply estimates be developed without certain assumptions as to trends in forestry. The future role of wood in the national economy is related to both demand and supply factors. Hence it is necessary to make a choice between such basic assumptions as peace or war, prosperity or depression, population growth or decline, and rising or falling standards of living.

General Assumptions

The key assumptions to which the Timber Resource Review is geared are: Peace but continued military preparedness, a rapid rise in population, economic prosperity and high living standards as reflected in a much larger gross national product, continued importance of forest products as a basic raw material, and continuation of present trends in forestry.

These general assumptions are translated into a series of specific economic projections which serve as the basis for subsequent projections of future demands for timber. The specific projections are derived mainly from data of the Department of Commerce utilizing accepted methods. They are generally in line with the economic projections made by a number of other agencies. However, most economic forecasters do not extend their projections to the year 2000. Consequently, the economic projections for that year have been developed independently by the Forest Service, following the same methods used by the Bureau of the Census for shorter term projections.

In projecting the general assumptions into the future, two sets of specific projections first were developed for both 1975 and 2000. There was very little difference between them for 1975, so the upper group was discarded for that year. As a consequence, one set of economic projections was used in developing timber-demand estimates for 1975 but two sets were used in connection with the demand estimates for the year 2000. The more conservative set of economic projections form the basis for the lower and medium estimates of timber demand. Such projections reflect an intermediate rate of future national economic growth. The second set of economic projections for 2000 are geared to top-level estimates of population and gross national product, and serve as the base for the upper estimate of timber demand in that year.

An infinite variety of other economic projections could have been used. Those chosen are believed to be reasonable. They reflect the general assumptions of peace, prosperity, military preparedness, and continued improvement in living standards. To adopt any other outlook in appraising a renewable natural resource such as timber, which requires time to mature, would be undesirable public policy.

Projections of Population and Gross National Product

The specific economic projections are essential prerequisites to estimating future timber demand and as such set the stage for the future and are of fundamental importance (table 1).

Of the several economic projections shown in table 1, population and gross national product, which is the total national output of all goods and services, are the two used most frequently in the subsequent estimations of timber demand. The other economic projections itemized in table 1 following population and prior to gross national product, such as total labor force, civilian force, unemployed, employed civilians, work week, and man-hour productivity are essential prerequisites to calculation of the gross national product.

The population projections are most readily understood. They are that population will increase to 215 million persons in 1975 and 275 million persons in 2000 (fig. 2). In contrast to the 1952 population of 157 million people, the estimated increases are 37 percent by 1975 and 75

TABLE 1.—*Economic projections used in estimating future demand for timber*

Item	Unit	1952	1975	2000: For lower and medium timber projections	2000: For upper timber projection
Population	Million people	157.0	215	275	360
Total labor force	do	66.4	85.0	110	133
Armed forces	do	3.4	3.5	4.0	4.0
Civilian labor forces	do	63.0	81.5	106	129
Unemployed	do	1.7	3.5	4	5
Employed civilians	do	61.3	78.0	102	124
Work week	Hours	40.2	35	30	30
Man-hour productivity	Dollars [1]	2.56	4.50	7.50	7.50
Gross national product	Billion dollars [1]	354.1	630	1,200	1,450
Input of physical structure materials	Billion index units [2]	5.9	8.3	12.2	14.7
Disposable personal income	Billion dollars [1]	238	441	840	1,015

[1] In 1953 constant dollars. [2] Measured in dollars at 1935–39 prices.

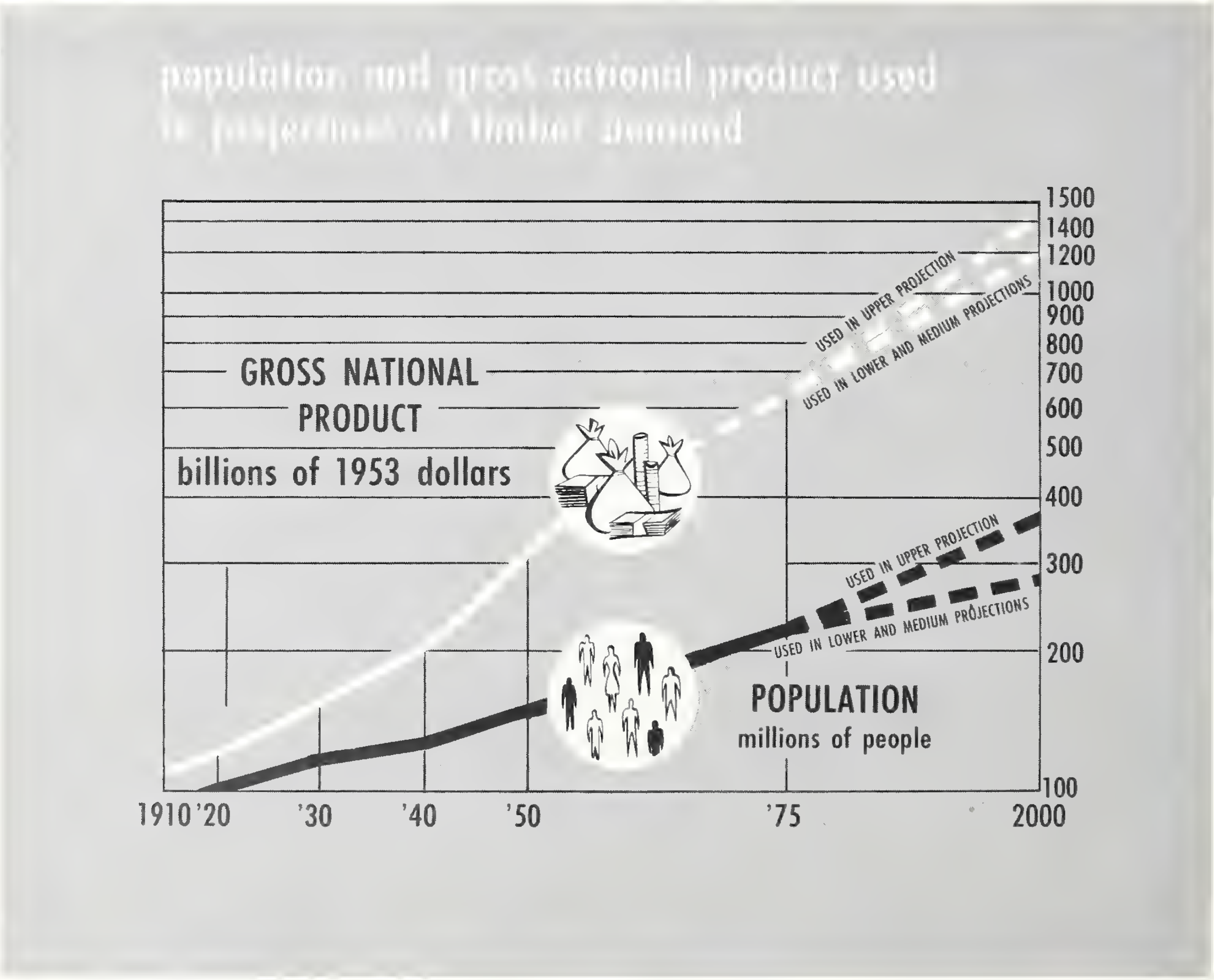

Figure 2

percent by 2000. The upper projection of population for 2000 is 360 million people, or a 130-percent increase over 1952. It is an extension of the upper level Census Bureau estimate for 1975 of 229 million people.

Despite these substantial percentage increases, the lower population projection is essentially conservative for several reasons: (1) The 1975 estimate of 215 million people is 3 million below the midpoint of the latest (1955) Census Bureau projections for 1975. (2) The year 2000 estimate of 275 million people is 23 million below the midpoint of the Forest Service extension of Census Bureau projections. (3) The population projections assume no further decline in mortality rates; yet it is reasonable to believe this will occur. (4) In the 52-year period, 1900–52, the population in the United States increased 106 percent, or at a compound rate of 1.4 percent annually. The basic population projection for the 48-year period, 1952–2000, is an increase of 75 percent, or at a compound rate of 1.2 percent annually. Thus the population projection is predicated upon a lesser rate of increase than has prevailed in the past. (5) Most long-term economic projections of this country's growth which have subsequently been tested by time have fallen short of actuality.

The 1945 Timber Reappraisal report of the Forest Service, accepting the population projections current at that time, assumed 145 million people for 1950, whereas the Bureau of the Census later enumerated 152 million for that year. Likewise, the Reappraisal indicated a population of 167 to 185 million by 2000. This is roughly 100 million persons less than the basic population of 275 million used in this study. This difference in population forecast is one of the fundamental reasons for the differences between projected demands for timber made by the Forest Service in its 1945 report and the estimates developed in the Timber Resource Review.

The second major economic projection is gross national product. It is predicated on population increases as described, on an enlarged total labor force, an approximately stable military force, an increase in the number of employed civilians despite increases in the numbers of unemployed, a decline in the length of the work week, and improved man-hour productivity.

On the basis of such factors, the gross national product is estimated to increase about 78 percent by 1975, or from 354 to 630 billion dollars. It is further estimated to approximately double from 1975 to 2000, and to reach 1,200 billion dollars (fig. 2). Although these are very large increases, they are at a lesser rate than has prevailed in the past, and in this respect the estimates for gross national product like those for population are believed to be reasonably conservative. In the 48-year period, 1952–2000, the estimated increase in gross national product is 240 percent, which is less than the 262-percent increase in the 45-year period, 1910–55. The top estimate for gross national product in 2000 used for the upper projections of timber demand is 1,450 billion dollars.

In both projections of gross national product, the rate of increase is greater than the rate of population increase (fig. 2). This is due to an allowance for improvement in standards of living which are reflected in gross national product but not in numbers of people.

The input of raw materials is another important economic criterion. It is important in timber demand estimates because the demand for timber is related in a general way to the demand for all raw materials. The three general types of raw materials are food, energy, and physical structure materials. The latter includes everything which is not in the food or energy classifications. It includes all wood products except fuel, which is in the energy group.

Because fuelwood is such a minor component of total wood consumption, only the physical structure materials were considered in projecting the input of raw materials. This, however, is a very broad grouping which includes many unlike materials. A common unit of measure for such materials is the "input index," which reflects both quantity and value and is defined as the quantity of each material that could have been bought for one dollar at the 1935–39 national average price. The total input index of physical structure raw materials in 1952 was 5.9 billion units, of which timber products comprised about 20 percent.

The projected input index of physical structure raw materials is an increase from 5.9 billion units in 1952 to 8.3 and 12.2 billion units in 1975 and 2000, respectively. These are increases of 40 and 107 percent. For the top projection 2000, the estimated increase in input index in relation to 1952 is 149 percent.

Disposable personal income is an economic criterion which reflects standard of living. It is estimated that disposable personal income (personal income after taxes) will increase from 238 billion dollars in 1952 to 441 and 840 billion dollars in 1975 and 2000, respectively.

In summary, the key economic criteria and estimated change in relation to 1952 are:

		2000	
	1975 (percent)	*Used in lower and medium timber projections (percent)*	*Used in upper timber projections (percent)*
Population	+37	+75	+130
Gross national product	+78	+240	+310

TIMBER IN THE NATIONAL ECONOMY

The purpose here is to summarize a few general criteria that indicate the widespread dependence of our economic structure on timber products.

Timber products consumption is discussed later (page 12).

Timber-connected activity in 1952 accounted for 6 percent of the man-years of employment, 6 percent of compensation paid to all employees, and 5 percent of our national income, as these estimates [5] show:

	Total	Timber-connected
Man-years of employment____millions__	63	3.4
Compensation of employees_billion dollars__	195	11
National income_______________do____	290	15

Timber-connected employment totaled 3.4 million man-years in 1952 and was heaviest in the fields of lumber manufacture, pulp and paper manufacture, and contract construction, as indicated below:

	Employment	
Timber-based industries:	Thousand man-years	Percent
Forestry	65	2
Lumber and timber basic products	655	19
Pulp, paper and allied products	504	15
Wood furniture and fixtures	310	9
Total	1,534	45
Other timber-connected activities:		
On farms	300	9
Contract construction (nonfarm)[1]	700	20
Rayon and other wood chemicals	236	7
Timber product transportation	228	7
Wholesale and retail trade	400	12
Total	1,864	55
All activities	3,398	100

[1] Does not include force account construction because of lack of data.

Sources: U. S. Department of Commerce, *National Income, 1954 edition*, Washington, D. C., 1955, and other Department of Commerce statistics.

Another important index of the role of timber products in the national economy is the proportion they comprise of the total mix of physical-structure raw materials (fig. 3). During the early 1900's timber products (other than fuelwood) comprised close to one-third of total consumption of physical-structure materials. The proportion grew steadily less for the next 20 years, from 1910 to 1930. In the 1930's and early 1940's, it diminished still further, but then the trend was reversed. During 1950–52, timber comprised about 20 percent of the total physical-structure raw materials intake, which is about the same as it comprised during the period 1925–40. Thus there appears to be no current trend downward in the importance of timber products in the national economy.

A marked shift in product composition toward pulpwood and an expected further shift in the same direction lends new strength to the role of timber in the national economy. This shift has opened profitable outlets for large volumes of wood otherwise not usable. In the early 1900's pulpwood comprised about 2 percent of the industrial wood input, veneer and minor products about 25 percent, and lumber more than 70 percent (fig. 4). By 1952, pulpwood had increased to 27 percent of the total, lumber had declined to 62 percent, and minor products had also declined.

Outlook for Forestry

The outlook for forestry in a national setting as just described could hardly be other than favorable. There have been relatively high prices, strong demand, and no general depression in recent years. Forestry is being practiced on both private and public lands at an accelerated rate. It is increasingly recognized that growing timber is economically profitable under certain conditions, particularly where forest industries have substantial timber and financial resources.

Adjustments of a financial character favorable to forestry and forest industries have recently been made, such as the 1943 timber capital gains amendment to the Internal Revenue Code and the Federal tax amortization program under which accelerated write-off of new plant investment was permissible. In 1953, national banks were authorized to make loans for terms up to 10 years secured by forest tracts "which are properly managed in all respects."

In general, Federal, State, and private forestry programs are moving forward, some more rapidly than others. Short term ups and downs have occurred, but over the last several decades the progress in forestry has been remarkable. Least progress has been made on the most important segment of the total forest situation—the four and one-half million small farm and other small private holdings that comprise over half of the commercial forest land. Private-public relations in forestry are improving as is mutual respect and confidence and a tendency to work together in greater harmony toward common objectives.

One of the most important assumptions for the future made in the Timber Resource Review is that recent improved trends in forestry will continue. Projections of inventory and growth are based on this assumption rather than on status quo in forestry. Improvements in utilization have been considered in adjustment of the utilization factors converting projected demand to timber cut. Full account has been taken of trends toward accelerated planting, improved protection, cultural and other forest management measures. Tangible recognition of progress in forestry was made in the projections of timber inventory and growth.

[5] Sources: U. S. Department of Commerce, *National Income, 1954 edition*, Washington, D. C., 1954, and U. S. Department of Commerce and U. S. Bureau of the Census statistics.

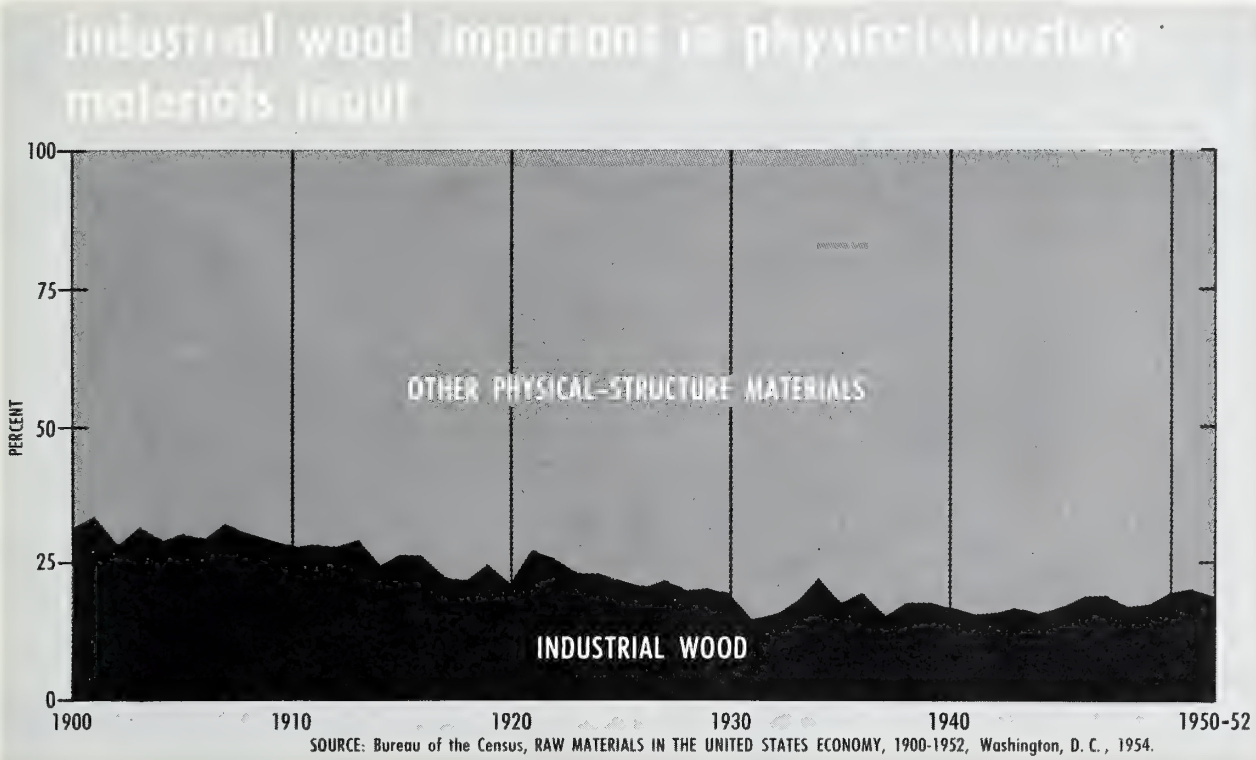

Figure 3

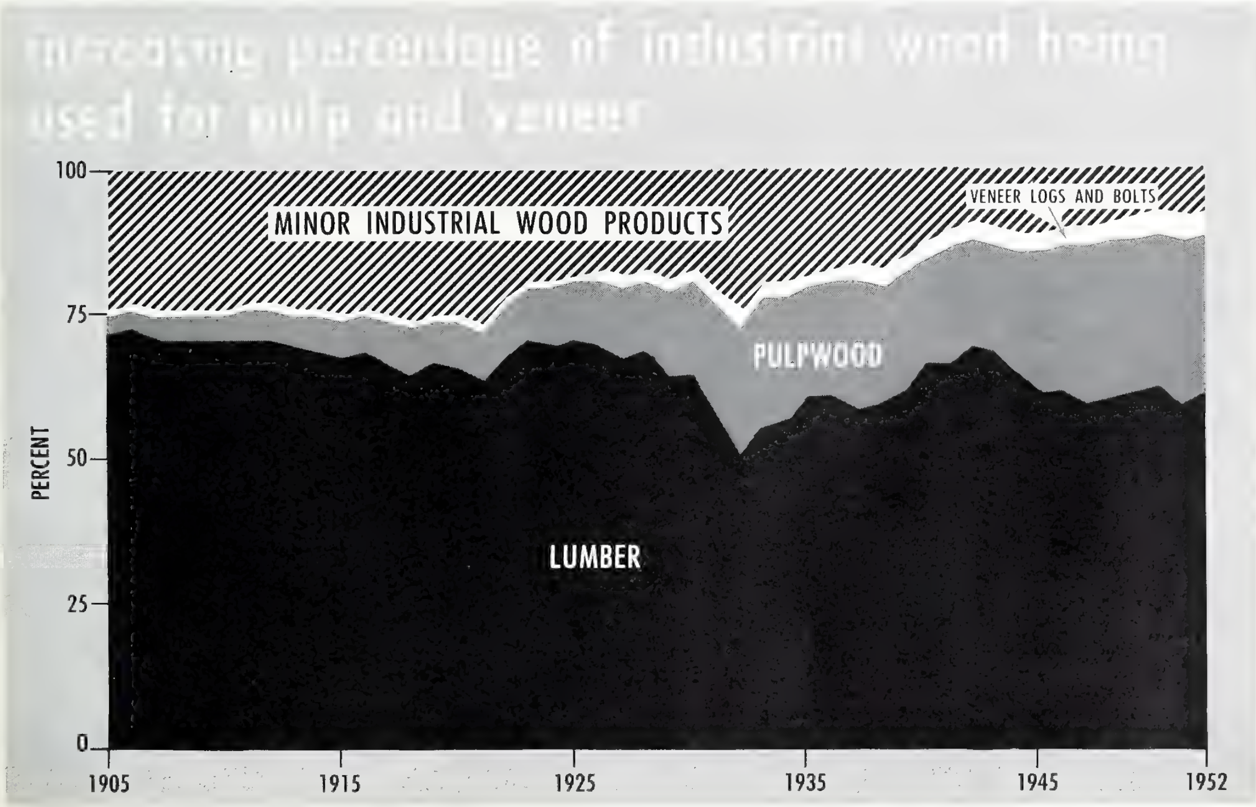

Figure 4

DEMAND FOR WOOD IS INCREASING

Before reviewing present and prospective timber supplies in the United States, it is important to outline prospective demand in order that the reader may have before him a clear picture of the Nation's need for wood against which may be appraised the present and prospective timber situation and growth.

Consumption of timber products and prospective timber demand are very nearly the same thing except with respect to time. Consumption is what has happened, whereas prospective demand is a projection of what may happen in the future under assumed conditions. Timber consumption is of value not only as an indicator and guide to the future, but also as a matter of historical interest.

Timber Products Consumption

Consumption by principal individual timber products for the few years that such estimates have been assembled are summarized in table 2. The volume of timber products consumed in 1952, expressed in terms of the cubic foot volume of logs and bolts (roundwood), amounted to 12.3 billion cubic feet or 78 cubic feet per capita. Products other than fuelwood accounted for 84 percent of that total: Saw logs 52 percent, pulpwood 22 percent, veneer logs and bolts 4 percent, and all other nonfuel products 6 percent. Fuelwood accounted for 16 percent (fig. 5).

Consumption of industrial wood (timber products other than fuelwood) increased moderately from 1900 to 1907, then declined rather steadily through 1921. There was a sharp upturn then for 2 years, followed by a moderate decline through 1929, and a drastic reduction during the depression that continued through 1932 to a low point in that year of 3.9 billion cubic feet. Gradually, from 1933 through 1942, consumption increased to a point just under the 1907 peak. There was a drop in consumption during the production difficulties through the war years, but this was followed by an upswing since 1949 in which consumption in each of the years 1950–52 was higher than the previous peak in 1907. This is indicated in the following tabulation:

Year:	Industrial wood [1] Total (billion cu. ft.)	Industrial wood [1] Per capita (cubic feet)
1900	8. 8	116
1905	9. 1	109
1910	9. 5	103
1915	8. 5	85
1920	8. 2	77
1925	8. 8	76
1930	7. 0	57
1935	5. 9	46
1940	8. 0	61
1945	7. 8	56
1950	10. 1	67
1951	10. 1	65
1952	10. 3	66

[1] This same long-term trend, including the intervening years, is shown in figure 111 and table 206 of the section on Future Demand for Timber.

Table 2.—*Estimated consumption of timber products in the United States*

Product	Standard unit of measure	Volume in standard units 1944	Volume in standard units 1950	Volume in standard units 1952	Volume in roundwood [1] 1952	
		Million	*Million*	*Million*	*Million cu. ft.*	*Percent*
Saw logs (lumber, sawn ties, etc.) [2]	Bd.-ft. lumber tally	34, 600	40, 850	41, 462	6, 419	52. 3
Veneer logs and bolts	Bd.-ft. log scale	1, 533	2, 730	2, 647	451	3. 7
Pulpwood [3]	Standard cords	21	34	35	2, 697	22. 0
Cooperage logs and bolts	Bd.-ft. log scale	737	690	355	73	. 6
Piling	Linear feet	45	32	41	28	. 2
Poles	Pieces	4	7	6	88	. 7
Posts (round and split)	do	275	230	306	194	1. 6
Hewn ties	do	25	12	10	67	. 6
Mine timbers (round)	Cubic feet	150	100	81	81	. 7
Other industrial wood [4]	do	250	250	227	168	1. 4
All industrial wood	Cubic feet roundwood [1]	8, 257	10, 145	10, 266	10, 266	83. 6
Fuelwood	Standard cords	70	62	59	2, 008	16. 4
All timber products	Cubic feet roundwood [1]	11, 632	12, 272	12, 274	12, 274	100. 0

[1] The roundwood (logs and bolts) volume of pulpwood, of "other industrial wood," and of fuelwood includes only that cut directly from trees. Plant residues utilized for such products are part of the roundwood volume principally of saw logs and veneer logs and bolts.

[2] Estimates of apparent consumption based on estimated production, less exports, plus imports, and changes in lumber stocks.

[3] Includes net imports of pulpwood, also of woodpulp and finished paper expressed in terms of pulpwood.

[4] All other timber products not including fuelwood.

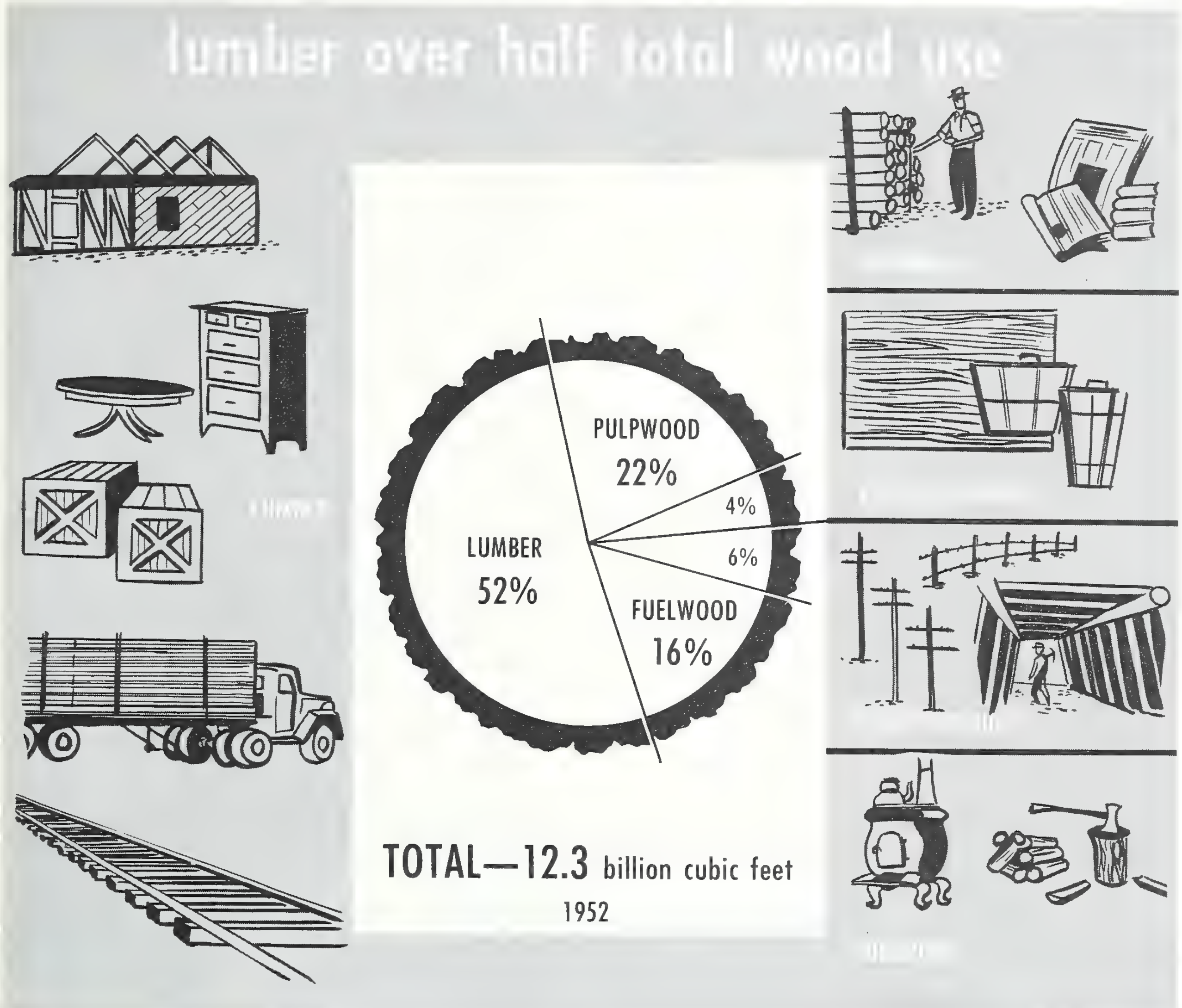

Figure 5

includes Coastal Alaska

Per capita consumption of industrial wood decreased from 116 cubic feet in 1900 to 46 in 1935, but has since increased to about 66 cubic feet in 1952. This increase of about 40 percent in the per capita consumption of industrial wood in the past 20 years is a significant change and shows that wood, contrary to the popular belief, is more than holding its own in the general economy.

The long-term trends in lumber consumption and pulpwood consumption, which are the two principal timber product items per capita, are summarized in table 3. Per capita consumption of lumber has gradually dropped over the past half century from 539 board-feet in 1900, with various ups and downs to about half that in 1952 (264 board-feet) and down to 248 in 1955. This is still high in relation to numerous other nations of the world. However, Canada and New Zealand consume more board-feet per capita than the United States, their average being in the neighborhood of 280 board-feet. Norway and Sweden consume about 210 and 150 board-feet per capita, respectively; USSR, 130 board-feet per capita; United Kingdom, 68; France, 42; Brazil, 25.

In contrast to the downward per capita trend in lumber consumption in the United States, the trends in per capita consumption of pulpwood and total pulpwood consumption have both been strongly upward. Since 1920 the per capita consumption of pulpwood has increased about threefold.

Although long-term consumption trends are available for industrial wood and for certain components such as lumber and pulpwood, there are

TABLE 3.—*Consumption of lumber and pulpwood for specified years*

Year	Lumber [1]		Pulpwood [2]	
	Total	Per capita	Total	Per capita
	Billion bd.-ft.	*Bd.-ft.*	*Million cords*	*Cords*
1900	41.0	539	------	------
1905	42.4	506	3.4	0.04
1910	43.4	470	4.9	.05
1915	36.7	365	------	------
1920	34.6	325	8.2	.08
1925	40.2	347	10.8	.09
1930	30.0	244	13.2	.11
1935	23.3	183	13.8	.11
1940	34.3	260	18.0	.14
1945	30.6	219	23.0	.16
1950	40.7	268	33.7	.22
1951	39.0	253	36.2	.23
1952	41.5	264	35.4	.23
1953	38.5	241	37.8	.24
1954	39.4	243	38.2	.24
1955	41.0	248	41.6	.25

[1] Estimates of apparent consumption based on estimated production, less exports, plus imports. Adjustments for changes in lumber stocks during period 1930–52.

[2] Includes net imports of pulpwood, also of woodpulp and finished paper expressed in terms of pulpwood.

no long-term trend estimates for all timber products in the United States because of the lack of fuelwood information. In the early 1900's, it is estimated that fuelwood consumption was about 100 million cords. It has since dropped to about 59 million cords in 1952. The per capita consumption of fuelwood dropped from 1.3 cords to 0.4 cords during this period, or a 70-percent decrease. Although fuelwood at the turn of the century represented a major fraction of all energy materials consumed, by midcentury it accounted for only a minor fraction because of the substitution of other fuels (fig. 6). It seems most likely that the competitive position of wood as an energy material will continue to weaken.

In summary, there are several significant trends that should be mentioned.

1. The long-term trend of product composition of industrial wood products is for a decrease in the proportion that lumber makes of the total, increases in the proportions of pulpwood and veneer logs and bolts, and a decrease in minor industrial wood products. Lumber, however, still makes up well over half of the total consumption of industrial wood products.

2. There has been a decrease of about 70 percent in the consumption of fuelwood since 1900. Although fuelwood in 1952 still made up 16 percent of the consumption of all timber products,

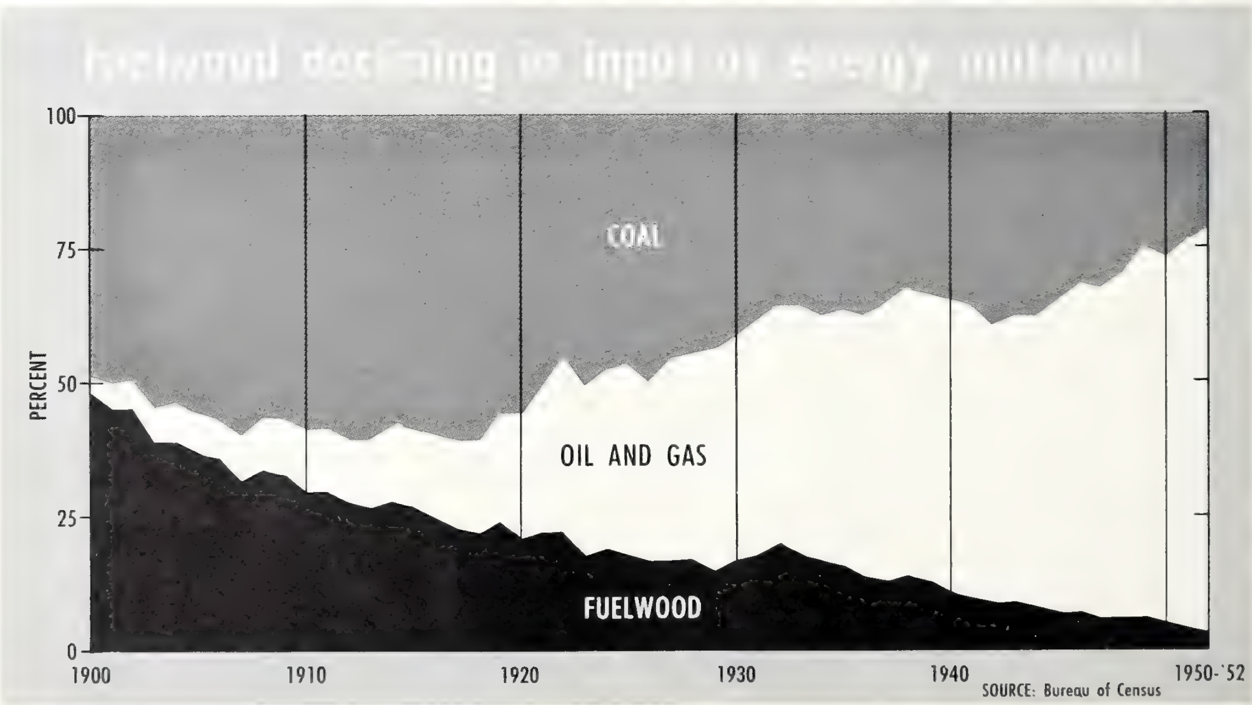

Figure 6

the importance of fuelwood may be expected to grow progressively less.

3. There has been more than a 50-percent decrease in per capita consumption of lumber since 1900. Despite this the total consumption of lumber has held up and has increased substantially since the 1930's. In 1955, it was at approximately the same level as in 1900.

4. Perhaps the most outstanding major development in wood consumption has been the rapid increase in use of pulpwood. The per capita consumption of pulpwood has tripled since 1920. The actual consumption of pulpwood was five times greater in 1955 than in 1920. As a result of these increases, pulpwood now makes up over one-fourth of the total consumption of industrial wood products whereas it comprised only 2 percent in the early 1900's. Pulpwood is the principal cause for wood maintaining about the same proportion (20 percent) of the total mix of physical-structure raw materials in 1952 as it comprised in 1925–40.

5. Since 1935, there has been an upswing in both total and per capita consumption of all industrial wood. Total consumption in 1952 was at an all-time high and per capita consumption was at the 1929 level.

Timber Demand

Meaning of Projected Timber Demand

Estimates of potential demand for timber products at specified future times under various sets of assumed conditions are termed "projected timber demand." Such estimates are not to be regarded as forecasts of actual future consumption of timber products. They are somewhat analogous to the potential demand estimates frequently made by large manufacturing concerns to serve as guidelines for planning their marketing and production facilities.

Attempts to look 25 to 50 years into the future entail much uncertainty about every factor to be considered. Nevertheless, it is impossible to escape the fact that the growing of commercial timber inevitably involves the planning of operations over long periods of time. What is done on the forest lands of the United States during the next decade or two will largely determine the supply of timber in the year 2000.

Much has been done in the past to improve the outlook for timber supply. Much more can be done to improve it still further. Policy decisions as to what is needed depend to a considerable degree on estimates of projected demand for timber products.

For any enterprise as economically important as the production and utilization of timber products, supply plays some role in the generation of its own demand, and demand certainly exerts an influence upon supply. In case of timber, however, response on the supply side cannot become effective in one year or in ten. The apparent ease or difficulty of economically developing a supply commensurate with projected timber demand provides some clue as to future trend of timber prices. Prospective demand higher than prospective supply indicates a probability of upward movement of timber price, but higher and higher relative price for one of the Nation's basic raw materials would not be conducive to continued improvement in the general standard of living. It would not be good public policy to base forestry programs for the future solely upon estimates of either potential demand that assumes a further substantial increase in the relative price of timber products or future timber supplies less than the Nation can reasonably grow.

Three Levels of Demand Developed

Three projections of timber demand have been made. For convenience these are termed "medium projection," "upper projection," and "lower projection." The medium and lower projections of timber demand are developed for both 1975 and 2000. Upper projected demand is developed only for 2000. The reason for this is that the assumptions upon which upper projected demand would be based for 1975 were so nearly the same as those upon which medium projected demand is developed for that year that no separate upper projection was made for 1975.

Medium projected demand is the basic projection. The upper and lower projections are variants from it. The medium projected demand is based upon certain population, gross national product, and price assumptions. The upper projected demand uses the same price assumptions as the medium projection, but the population and corresponding gross national product are increased. On the other hand, the lower projection uses the same population and gross national product assumptions as the medium level, but the price assumption is different. The key assumptions for each of the three projections are shown in table 4.

A great many other projections of timber demand could be made. The purpose of making three projections is to provide a range so that the reader may select such projection or demand as seems most reasonable and desirable to him in the light of the assumptions upon which the demand projections are based.

In considering the subsequent projections of timber demand, it is important to bear in mind:

1. Populations assumed for the medium and lower projections are basically conservative.

2. Each of the three projections is based on specific assumptions as summarized above. None is a casual estimate.

TABLE 4.—*Key assumptions for projections of timber demand*

Projections	Population		Gross national product in 1953 dollars		Price
	1975	2000	1975	2000	
	Millions	*Millions*	*Billion dollars*	*Billion dollars*	
Medium	215	275	630	1, 200	No change in relative prices; trends in future price of timber products will, in general, parallel price trends of competing materials.
Upper	[1] 228	360	[1] 645	1, 450	Same as for medium projection.
Lower	215	275	630	1, 200	Future prices of timber products will rise substantially faster than prices of competing materials; with resulting extensive price-induced substitution of non-wood materials for timber products.

[1] Not used. So close to medium level that upper level projections were not estimated for 1975.

3. None of the projections is a forecast of what will occur. They are alternative choices based upon reasonable assumptions. An infinite variety of other alternatives could be developed.

In general terms, both the medium and upper projections are based on assumptions which mean that industrial timber products would occupy about the same relative role in the economy as they do today. The only difference between the two is a larger population for the upper projection. The medium and upper levels assume in effect a status quo role for wood. In contrast, the lower projection assumes higher relative prices and a declining role for wood in which industrial wood would become relatively less important in the economy of the Nation in the future than it is today.

The Forest Service believes that the medium projection offers a reasonable and desirable objective as a matter of public policy. This is so for two reasons: (1) It is desirable to grow a continuing supply of wood as a basic and renewable raw material in such amounts that wood may continue in the future to occupy about the same role in the national economy as it does at present; and (2) the amount of timber that must be grown to meet the medium projected demand is shown to be reasonably obtainable although rapid acceleration and intensification of forestry will be required.

Summary of Timber Demand Projections

The translation of the economic assumptions summarized above to projections of timber demand is a complex, detailed, and highly technical process which is explained fully in the section on Future Demand for Timber. The purpose in this section is to summarize the end results for each of the three projections and for both 1975 and 2000.

All Projections Point to Demand Higher Than 1952 Consumption

Projected demand for 1975 and 2000, and consumption in 1952 are summarized by products in tables 5 and 6 and figure 7. In table 5 the projections are in terms of standard units of measure for the individual products. In table 6 a conversion to cubic feet of roundwood has been made in order to permit the development of totals.

Combining all products, the lower, medium, and upper projected timber demands in 2000 are 46, 83, and 114 percent greater, respectively, than 1952 consumption (table 7). Lumber demand for the medium projection in 2000 is 91 percent above the 1952 consumption and the corresponding increase for pulpwood is 182 percent.

In terms of industrial wood, the increases in relation to 1952 are even more striking than for all timber products. The reason for this is that fuelwood was about 16 percent of all timber products consumed in 1952 and the projection for fuelwood indicates nearly a 60-percent decline by 1975 and a 74-percent decline by 2000. In other words, it is expected that fuelwood will decline from 16 percent of the total in 1952 to 2 percent of the total by 2000. Such a rapid decline of an important item offsets in part the large increases in lumber and pulpwood. In terms of industrial wood which is believed to be the better indicator, the medium projected demand indicates a 50-percent increase over 1952 by 1975 and 114-percent increase by 2000.

TABLE 5.—*Estimated domestic consumption of timber products, 1952, and projections of domestic demand, 1975 and 2000* [1]

Product	Standard unit of measure	Domestic consumption, 1952	Projections of domestic demand: 1975 Lower	1975 Medium	2000 Lower	2000 Medium	2000 Upper
		Million units	*Million units*	*Million units*	*Million units*	*Million units*	*Million units*
Saw logs for lumber [2]	Bd.-ft. lumber tally	41, 462	47, 600	55, 500	54, 800	79, 000	90, 000
Pulpwood [3]	Standard cords	35. 4	65	72	90	100	125
Veneer logs and bolts [4]	Bd.-ft. log scale	2, 647	5, 000	5, 670	7, 500	9, 000	10, 500
Cooperage logs and bolts	do	355. 3	510	600			
Piling	Linear feet	41. 2	45	59	*Million*	*Million*	*Million*
Poles	Pieces	6. 5	4. 9	6. 5	*cu. ft.*	*cu. ft.*	*cu. ft.*
Posts (round and split)	do	306	337	400	Not allocated to product		
Hewn ties	do	10. 2	-------	-------	1, 160	1, 450	1, 740
Mine timbers (round)	Cubic feet	81	87	105			
Other industrial wood	do	227	314	350			
					Million units	*Million units*	*Million units*
Fuelwood [5]	Standard cords	58. 6	34	34	25	25	25

[1] Includes net imports and volume of products recovered from plant residues.
[2] Lumber, timbers, sawn ties, etc.; includes saw-log equivalent of net imports of lumber.
[3] Includes pulpwood net imports and pulpwood equivalent of woodpulp and paper.
[4] Includes net imports of veneer logs and bolts or veneer-log equivalent of veneer and veneer products.
[5] For industrial as well as home use. Includes plant residues used for fuel.

TABLE 6.—*Estimated domestic consumption of roundwood for timber products, 1952, and projections of domestic demand, 1975 and 2000* [1]

Product	Domestic consumption, 1952	Projections of domestic demand: 1975 Lower	1975 Medium	2000 Lower	2000 Medium	2000 Upper
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Saw logs for lumber [2]	6, 419	7, 140	8, 383	8, 549	12, 090	13, 578
Pulpwood	2, 697	4, 698	5, 264	6, 514	7, 125	8, 925
Veneer logs and bolts	451	860	946	1, 301	1, 478	1, 724
Cooperage logs and bolts	73	97	109			
Piling	28	30	37			
Poles	88	67	88	Not allocated to product		
Posts (round and split)	194 } 699	175 } 675	224 } 795	1, 043	1, 227	1, 473
Hewn ties	67	-------	-------			
Mine timbers (round)	81	87	105			
Other industrial wood	168	219	232			
Total all industrial wood	10, 266	13, 373	15, 388	17, 407	21, 920	25, 700
Fuelwood	2, 008	818	818	519	519	519
Total all timber products	12, 274	14, 191	16, 206	17, 926	22, 439	26, 219

[1] Includes roundwood equivalent of net imports of timber, pulpwood, woodpulp and paper, veneer logs and bolts and veneer-log equivalent of veneer and veneer products. Includes roundwood volume cut from dead and cull trees. Volume of products recovered from plant residues is included in the roundwood volume from which the residue was obtained, principally saw logs and veneer logs.
[2] Lumber, timbers, sawn ties, etc.

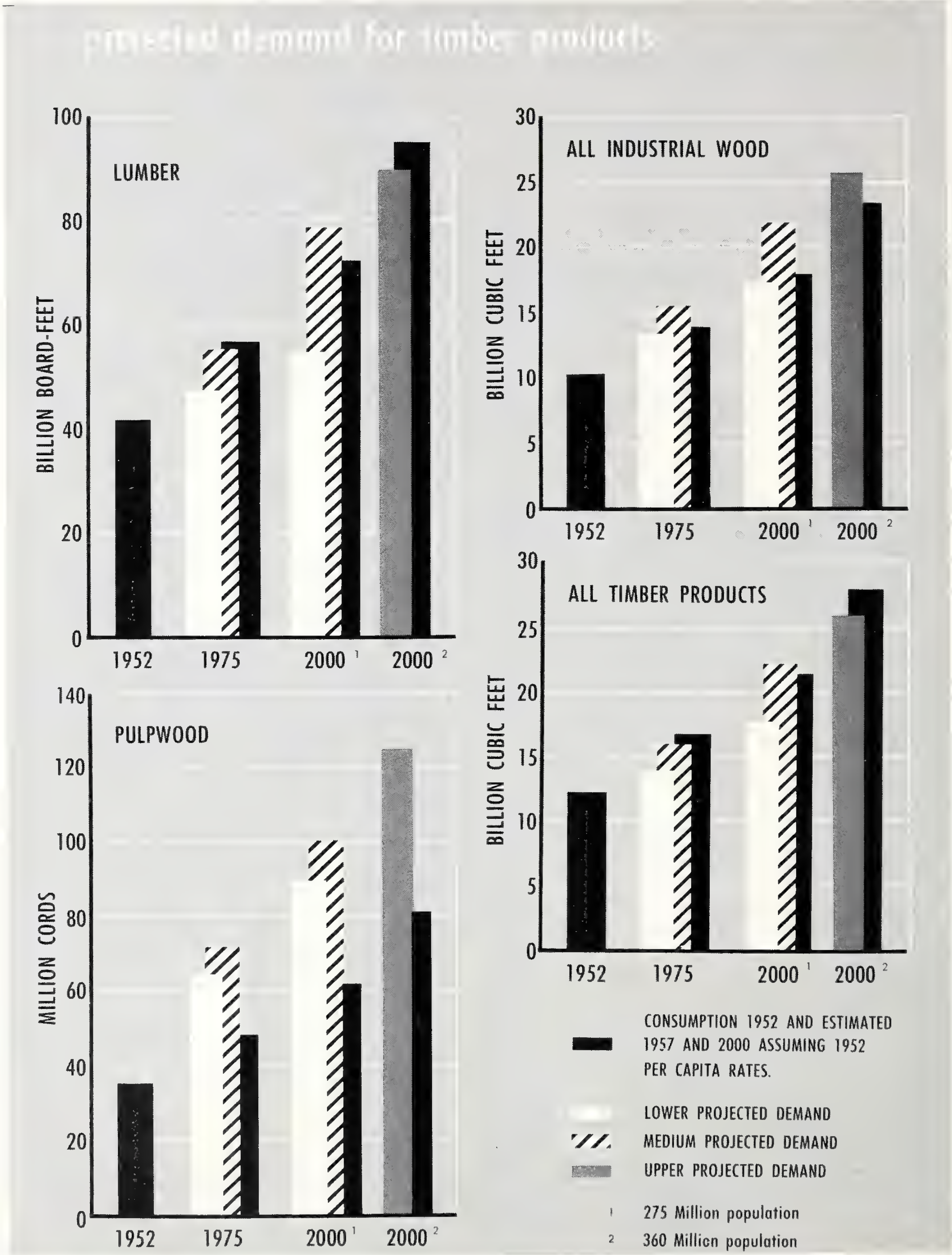
projected demand for timber products
LUMBER
BILLION BOARD-FEET
PULPWOOD
MILLION CORDS
ALL INDUSTRIAL WOOD
BILLION CUBIC FEET
ALL TIMBER PRODUCTS
BILLION CUBIC FEET
1952
1975
2000 1
2000 2
CONSUMPTION 1952 AND ESTIMATED 1957 AND 2000 ASSUMING 1952 PER CAPITA RATES.
LOWER PROJECTED DEMAND
MEDIUM PROJECTED DEMAND
UPPER PROJECTED DEMAND
1 275 Million population
2 360 Million population

Figure 7

TABLE 7.—*Consumption and projected demand for selected timber products and percentage change in demand from 1952 consumption* [1]

Item	Saw logs for lumber		Pulpwood		All industrial wood		Fuelwood		All products	
	Million bd.-ft.	*Percent* [2]	*Million cords*	*Percent* [2]	*Million cu. ft.*	*Percent* [2]	*Million cu. ft.*	*Percent* [2]	*Million cu. ft.*	*Percent* [2]
1952 consumption	41, 462		35. 4		10, 266		2, 008		12, 274	
Lower projected demand:										
1975	47, 600	+15	65. 0	+84	13, 373	+30	818	−59	14, 191	+16
2000	54, 800	+32	90. 0	+154	17, 407	+70	519	−74	17, 926	+46
Medium projected demand:										
1975	55, 500	+34	72. 0	+103	15, 388	+50	818	−59	16, 206	+32
2000	79, 000	+91	100. 0	+182	21, 920	+114	519	−74	22, 439	+83
Upper projected demand:										
2000	90, 000	+117	125. 0	+253	25, 700	+150	519	−74	26, 219	+114

[1] Includes roundwood equivalent of net imports of lumber, pulpwood, woodpulp and paper, veneer logs and bolts and veneer-log equivalent of veneer products. The 1952 estimates also reflect adjustments for changes in stocks.
[2] Change from 1952.

Per Capita Trend Downward for Lower Projections; Upward for Medium and Upper Projections

The increases in projected demand for lumber, pulpwood, and all industrial wood as summarized above seem extraordinarily large. Particularly is this so when expressed in terms of percentage increases relative to 1952 consumption (table 7).

The main reason for these large increases in total demand is the assumption with respect to population which, as previously pointed out, is predicated upon Census Bureau estimates. Even the lower projected demand indicates increases over 1952 consumption despite an assumption as to substantial increase in prices relative to competing materials. This means that the assumption as to increase in population more than offsets the assumption as to rise in price for the lower projected demand.

In terms of per capita consumption, the projected demand estimates appear quite different. Lumber, for example, shows a declining per capita demand for each level and for each of the two time periods except for the medium projection in 2000. Pulpwood, on the other hand, shows an increase in per capita demand for all three projections and for both 1975 and 2000.

In terms of all industrial wood, the lower projection shows a slightly declining per capita consumption. This would be expected in view of the assumption as to price increases for that projection. On the other hand, for all industrial wood both the medium and upper projected demands show increased per capita demand over 1952. These increases in per capita demand shown in table 8 and figure 8 are reflections of improvements in standard of living. This was also evident in the greater rate of increase projected for gross national product than for population.

As shown in table 8 and figure 8, the upper projected per capita demand in 2000 is not as high as the per capita demand for the medium projection in that year. This is true with respect to lumber,

TABLE 8.—*Per capita consumption and projected per capita demand for selected timber products*

Item	Lumber	Pulpwood	All industrial wood	Fuelwood	All products
	Board-feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*
1952 consumption	264	17. 2	65. 4	12. 8	78. 2
Lower projected demand:					
1975	221	21. 9	62. 2	3. 8	66. 0
2000	199	23. 7	63. 3	1. 9	65. 2
Medium projected demand:					
1975	258	24. 5	71. 6	3. 8	75. 4
2000	287	25. 9	79. 7	1. 9	81. 6
Upper projected demand:					
2000	250	24. 8	71. 4	1. 4	72. 8

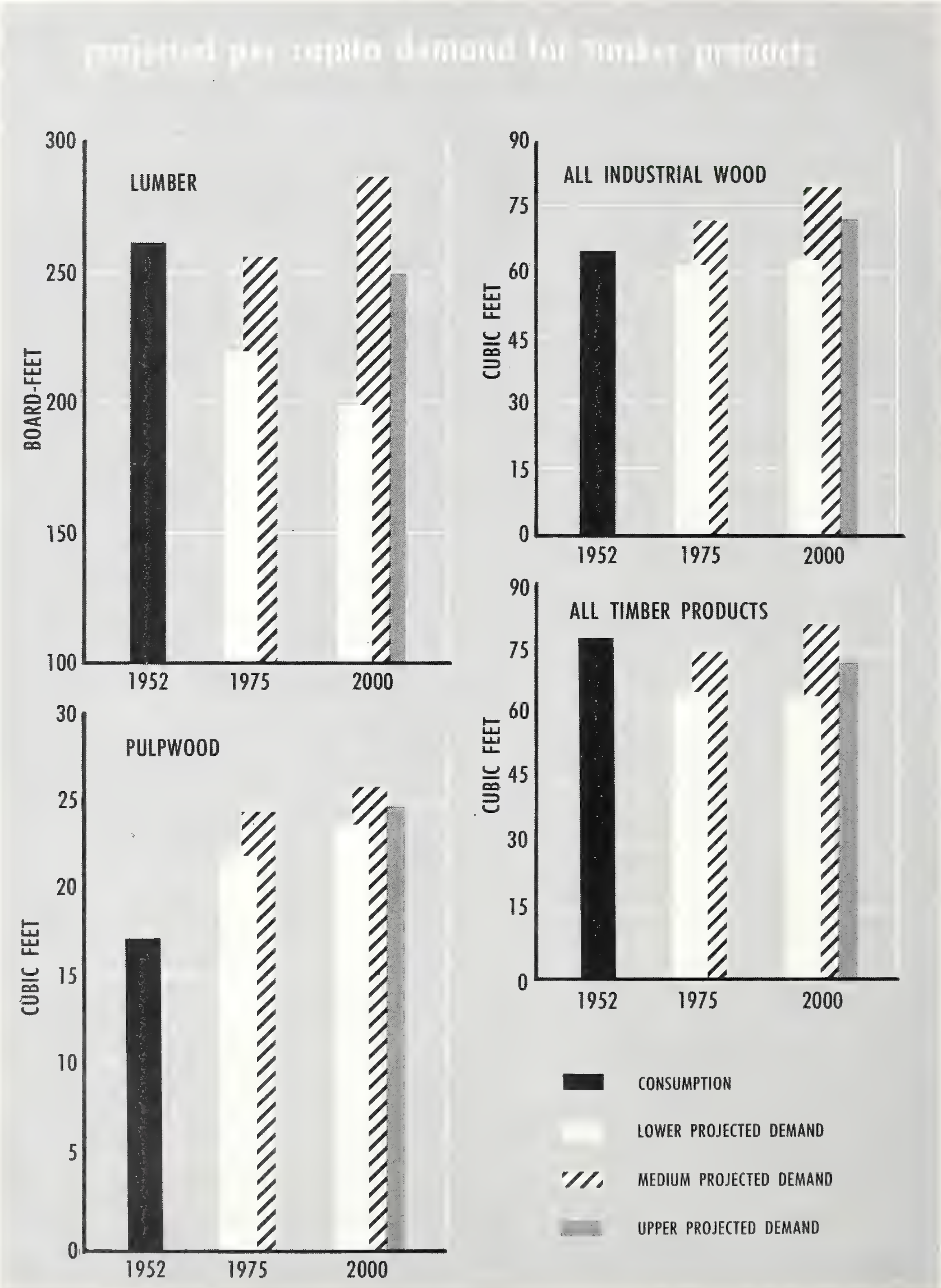
projected per capita demand for timber products
LUMBER
BOARD-FEET
300
250
200
150
100
1952
1975
2000
ALL INDUSTRIAL WOOD
CUBIC FEET
90
75
60
45
30
15
0
1952
1975
2000
PULPWOOD
CUBIC FEET
30
25
20
15
10
5
0
1952
1975
2000
ALL TIMBER PRODUCTS
CUBIC FEET
90
75
60
45
30
15
0
1952
1975
2000
CONSUMPTION
LOWER PROJECTED DEMAND
MEDIUM PROJECTED DEMAND
UPPER PROJECTED DEMAND

Figure 8

pulpwood, all industrial wood, and all timber products. This is due to the difference in the age composition of the 360 million population assumed for 2000 for the upper projection and the 275 million assumed for the medium projection. The 360 million has a much larger proportion of children and young persons not old enough to be in the labor force or to have established separate homes than does the 275 milllion. Another way of saying it is that the standard of living for the upper projection in 2000 is not quite as high as would be the standard of living if there were only 275 million persons in that year. Per capita disposable income, for example, might be about 8 percent less for the 360 million population than for 275 million. The term "upper projection," therefore, does not mean upper in terms of standard of living or per capita demand. It does mean "upper" in terms of population and total demand.

An interesting comparison is the amounts of the various timber products that would be consumed in 1975 and 2000 if per capita consumption in those years was the same as in 1952 (table 9) and a comparison of these amounts with projected demand (table 7). Holding per capita consumption the same, there would be a 37-percent increase over 1952 in each product and a 75-percent increase by 2000 for a population of 275 million, or a 129-percent increase in that year for a population of 360 million. The projected demand for lumber, for example, is less in all cases than would be consumption at the 1952 per capita rate except for the medium projected demand in the year 2000. The projected demand for pulpwood, on the other hand, exceeds what would be the consumption in both 1975 and 2000 at the 1952 per capita rate.

One of the most significant of all comparisons is that consumption of all timber products would increase from 12.3 billion cubic feet in 1952 to 28.2 billion cubic feet in 2000 with a population of 360 million if per capita rates are held the same. In contrast, the upper projected demand in 2000 for all timber products is 26.2 billion cubic feet. Thus holding per capita rates constant at the 1952 level would result in slightly greater consumption than meeting the upper projected demand in 2000. Even in terms of all industrial wood, the upper projected demand in 2000 would be only slightly more than consumption at the 1952 per capita rate.

These comparisons of per capita projected demand and per capita consumption at 1952 rates can only lead to the conclusion that the estimates of projected demand are reasonable and conservative.

TABLE 9.—*Consumption in 1952 of selected timber products and consumption in 1975 and 2000 if per capita rates continue constant*

Year and population	Change from 1952 [1]	Saw logs for lumber	Pulpwood	All industrial wood	Fuelwood	All timber products
	Percent	*Million bd.-ft.*	*Million cords*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
1952, 157 million		41, 462	35. 4	10, 266	2, 008	12, 274
1975, 215 million	+37	56, 760	48. 4	14, 061	2, 752	16, 813
2000:						
275 million	+75	72, 600	61. 9	17, 985	3, 520	21, 505
360 million	+129	95, 040	81. 0	23, 544	4, 608	28, 152

[1] Percentage changes are the same for each product grouping.

Projected Demand Converted to Timber Cut

Projections of timber demand have been expressed up to now in terms of either standard units of measure such as board-feet for lumber, cords for pulpwood, or linear feet for piling, or in terms of cubic feet of roundwood, which is the volume of logs and bolts cut from trees and taken out for use. Projections of demand in terms of cubic feet of roundwood include net imports. Thus, projections of demand expressed in either standard units of measure or cubic feet of roundwood volume correspond to estimates of past consumption with which they have been compared.

Before projections of demand can be related to growth and the inventory of standing timber as done in the last section on Timber Supply Outlook, they must be converted to the amount of timber needed to be cut from growing stock and sawtimber in order to supply the projected demand. This conversion is not a simple process and requires taking into account a number of factors such as the amount of timber exported and imported, trends toward improved utilization, and the portion of demand that may come from dead or cull trees, from noncommercial forest land, and from nonforest land. The steps in this process which are explained at the close of the section on Future Demand for Timber include: (1) Reducing the projected demand for each of the individual products listed in tables 5 and 6 by the estimated net imports for that product in order to obtain the domestic output, and (2) the application of utiliza-

tion factors to convert domestic output of each product to timber cut by making allowances for that part of the product manufactured from plant residues and nongrowing-stock sources, amounts wasted in logging, and savings due to better utilization. This results in the timber needed to be cut from growing-stock sources in order to meet projected estimates of demand. A portion of the timber cut is attributed to sawtimber; and the timber cut is divided between softwoods and hardwoods, roughly 70 percent to softwoods and 30 percent to hardwoods.

TABLE 10.—*Projected demand for timber products and associated timber cut, 1975 and 2000*

LOWER PROJECTED DEMAND

Year and species group	Total round-wood demand	Domestic output	Timber cut	
			Growing stock	Live saw-timber
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion bd.-ft.*
1975:				
Softwood	9.9	8.4	8.4	40.9
Hardwood	4.3	4.1	4.0	15.1
Total	14.2	12.5	12.4	56.0
2000:				
Softwood	12.5	10.9	10.3	49.6
Hardwood	5.4	5.2	5.4	19.4
Total	17.9	16.1	15.7	69.0

MEDIUM PROJECTED DEMAND

Year and species group	Total round-wood demand	Domestic output	Growing stock	Live saw-timber
1975:				
Softwood	11.4	9.9	9.6	47.6
Hardwood	4.8	4.6	4.4	17.8
Total	16.2	14.5	14.0	65.4
2000:				
Softwood	15.6	14.0	13.0	68.4
Hardwood	6.8	6.6	6.7	26.7
Total	22.4	20.6	19.7	95.1

UPPER PROJECTED DEMAND[1]

Year and species group	Total round-wood demand	Domestic output	Growing stock	Live saw-timber
2000:				
Softwood	17.9	16.3	15.3	79.5
Hardwood	8.3	8.1	8.1	31.5
Total	26.2	24.4	23.4	111.0

[1] Not estimated for 1975 because the difference between these demand projections and the medium projections, due to relatively slight differences in projections of population and gross national product, would be too small to be regarded as significant.

The savings to be expected in timber cut resulting from fuller utilization in both 1975 and 2000 are significant. It is estimated that about 5 percent less sawtimber will need to be cut in 1975 and in 2000 to satisfy projected demand as a result of better utilization than would be true if 1952 utilization standards continued to prevail. Improvements in utilization standards vary from about 2 percent for saw logs and veneer logs to 20 percent for pulpwood. The application of these revised standards means that to meet medium projected timber demand for 2000, 5.1 billion board-feet less of live sawtimber would need to be cut than under 1952 standards. Similar improvement is projected in utilization of growing stock.

The results of converting roundwood demand to domestic output and subsequently to timber cut are summarized in table 10 for the three levels of projected demand, for both 1975 and 2000, and for softwoods and hardwoods. The estimates of timber cut in table 10 provide the starting point for the analysis presented in the section on Timber Supply Outlook.

UNITED STATES IN RELATION TO WORLD TIMBER RESOURCES

Having completed a summary of future demands for timber, and before considering domestic timber resources, it is desirable to place United States' resources in their proper perspective by relating them to the timber resources of other nations. There are vast timber resources in other countries of North America, in other nations of the Free World, and in the Soviet Bloc of nations. A comparison of timber resources of the United States with those of other North American countries and other nations of the world affords insight as to the degree to which the United States may safely expect to rely on imports or may, on the other hand, increase its exports. The degree of self-sufficiency which the United States may need to attain is an important factor in appraising the domestic timber situation.

INTERIOR ALASKA [6]

Interior Alaska includes all of the Territory, except the timbered coastal strip as shown diagrammatically in figure 1.[7] Although Interior

[6] The timber resources of other United States' territories and possessions including the Commonwealth of Puerto Rico, the Virgin Islands, Hawaii, and Guam do not loom large in an appraisal of the future timber supply of the United States. The forests, through clearing for agriculture and grazing and uncontrolled cutting and fire, now support little commercial timber. The commercial forest area, which amounts to less than 1 million acres, is primarily valuable for water conservation and soil stabilization and will likely remain so because of the overriding importance of these resource values to the local economy.

[7] Shown in more detail in figure 101, p. 326.

Alaska is, of course, part of the United States, the timber resources of the Interior are not included in the statistical summaries nor the analytical discussions throughout the Timber Resource Review. The reason is that accurate information on the timber resources of Interior Alaska is almost nonavailable, and also that these resources are largely unexploited and thus would distort the picture of the United States' timber situation as it is known today. When more is known of Alaska's timber resources, and when they are subject to more active utilization, Interior Alaska doubtless will be included in subsequent timber appraisals as a region of the United States along with Coastal Alaska, which is included for the first time.

Although Interior Alaska has extensive resources, they are small in relation to those of continental United States. About 35 percent of Interior Alaska's total land area is forested. Of the 120 million acres of forest land, about 40 million acres, or 33 percent of the forested area and 12 percent of the total land area, might be classed as commercial forest land. This commercial forest land supports an estimated 32 billion cubic feet of timber, including 180 billion board-feet of sawtimber, with an estimated annual net growth of about 4 billion board-feet. The timber is very largely white spruce and paper birch. About 95 percent of the commercial forest land is in public ownership.

Expressed in other terms, Interior Alaska has a commercial forest area almost as large as that of Oregon and Washington. It has about one-half as much timber volume in cubic feet as the State of Washington and about 60 percent as much board-foot volume of sawtimber. Timber cut is only a fraction of one percent of current growth.

Total timber resources of Interior Alaska are substantially greater than those of Coastal Alaska. Although per acre timber volumes are much greater in the heavier stands along the coast, Interior Alaska has about ten times as much commercial forest area and about twice as much timber volume as found in Coastal Alaska, as the following comparison shows:

Region:	*Commercial forest area (million acres)*	*Growing stock (billion cu. ft.)*	*Live sawtimber volume (billion bd.-ft.)*
Interior Alaska	40	32	180
Coastal Alaska	4	19	89
Total	44	51	269

The main problems of this undeveloped resource are protection against fire, insects, and disease, and underutilization. There is an estimated annual mortality of about 2 billion board-feet, half of which is caused by fire. The forests of Interior Alaska need better protection. They also need to be made more accessible. And, of course, there is need for greater utilization and expanded markets. They offer an additional timber supply to the United States which is not now considered to be economically available, but which ultimately may enter into normal trade channels.

Canada

Canada is richly endowed with timber resources, especially softwoods. In relation to the United States, Canada has about 47 percent more forest land and about 9 percent more commercial forest land. As between hardwood and softwood forest types, Canada has 72 percent more softwood area but only 52 percent as much hardwood area.

In terms of total growing stock, Canada has 80 percent as much timber volume but almost the same softwood volume. Its hardwood volume is 43 percent of that found in the United States. Timber cut from growing stock as well as net annual growth averages about one-third of comparable volumes in the United States.

Although Canada has decidedly less sawtimber volume than continental United States, it has a much larger area of softwood timber. The United States has about twice as much softwood sawtimber volume as does Canada and five times the annual sawtimber growth of all species, as shown below.

	United States (billion bd.-ft.)	*Canada [1] (billion bd.-ft.)*
Live sawtimber volume, 1953:		
Softwood	1, 559	724
Hardwood	409	58
Total	1, 968	782
Sawtimber growth, 1952	47	9
Sawtimber cut, 1952	49	7

[1] Canada Dept. North. Affairs and Natl. Resources, Forestry Branch. Bul. 106, Amend. Ottawa, 1954. Board-foot growth and cut estimates derived from cubic-foot statistics on basis of inventory ratio of board-feet to cubic feet.

Important reasons for these differences are believed to be: (1) Forest sites on the average are less productive in Canada, a condition which is reflected both in size of trees and rate of growth, and (2) a much larger proportion of the total forested area is in uncut virgin condition and thus not contributing significantly to net growth. Timber growth may ultimately increase 50 to 60 percent above present levels when Canadian forests are under management and when old-growth forests have been converted to more productive stands.

The forest industries contribute substantially to the domestic economy of Canada. Fifteen percent of the net value of all industrial products in Canada is attributable to the forest industries. Employment on a man-year basis totaled about 370,000 persons in 1951, with more than a billion dollars paid in salaries and wages.

Canadian forest industry is growing rapidly, but plant capacity is far behind that of the United

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States. For example, there are, roughly, 8,000 sawmills compared to 60,000 in the United States. There are about 2½ times as many pulp and paper plants in the United States as in Canada, and over 10 times as many veneer and plywood mills.

Canadian-United States trade relations in forest products are important to both countries. Canada is a timber exporting nation. Of its total output, 73 percent of the veneer, 69 percent of the paper and paperboard, and 33 percent of the lumber are exported to the United States. Canada is the principal source of United States imports of timber products. For example, about 91 percent of all lumber imported by the United States comes from Canada, as does 82 percent of the woodpulp. A high proportion of our imports of other timber products likewise comes from Canada (table 11).

TABLE 11.—*Relative importance of the timber products trade between Canada and the United States, 1952*

Product	Proportion of Canadian output exported to U. S.	Proportion of U. S. imports that originate in Canada	Proportion of U. S. consumption imported from Canada
	Percent	*Percent*	*Percent*
Lumber	33	91	5
Pulpwood	15	99	9
Woodpulp	18	82	9
Paper and paperboard	69	96	17
Veneer	73	94	(1)
Plywood	10	67	(1)
All products	36	90–95	10

1 Negligible.

Ultimately, if Canadian forests increase present growth substantially, Canada may be able to support not only increased requirements resulting from rapid expansion of its own domestic economy, but also increased exports primarily in softwood species for pulp. In projecting United States domestic timber requirements, an allowance is made for a conservative increase in net imports chiefly from Canada from 1.18 billion cubic feet of roundwood in 1952 to 1.66 in 1975 and 1.79 in 2000. Canada might be able to support even greater exports to the United States depending on its domestic expansion, export requirements of other countries, and the rate of progress of forestry in Canada. However, the outlook for increased imports from Canada of softwood lumber of quality grades is not encouraging over the long run. At present rates of cutting, there appears to be a 25 to 50 years' supply of old-growth Douglas-fir, which is perhaps the most important source of high-quality lumber in Canada.

MEXICO

Mexico will not be an important factor in the United States' timber situation in the long run. Mexico has, roughly, a tenth as much forest land as the United States and a tenth as much timber. Hardwoods exceed softwoods both in forest area and timber volumes by ratio of two to one in Mexico, and the cubic-foot softwood timber volume is roughly equivalent to that of Coastal Alaska. The most important commercial softwoods consist of Mexican white, Apache, Montezuma, and Aztec pines, *Pinus leiophylla* and *Pinus oocarpa*, which occur mainly on the mountains of the Sierra Madre Occidental Range, extending southward through the western half of the country from the Arizona-New Mexico border. It is estimated that timber cut somewhat exceeds net timber growth. The limited size of Mexico's timber resources and limited utilization and growth would indicate that Mexico is not a significant factor in appraising the United States' outlook.

NORTH AMERICAN RESOURCES COMPARED TO THOSE OF THE FREE WORLD

To the extent data are available or estimates can be made, the timber resources of the various countries of North America are summarized as to area, volume, growth, and cut in table 12.

In addition to North America, the Free World includes Latin America, Free Europe, Free Asia, the Pacific area, and Africa. In comparison to total timber resources of the Free World, North America has only one-fourth of the total forested area but three-fourths of the total softwood area.

The only comparable estimates of timber volumes for the nations of the Free World or the world are for "forests under exploitation" which are limited to those forests currently yielding industrial wood or fuelwood. For the Free World, this includes only 2 billion acres of a total of 7.5 billion acres of forest land. And of these 2 billion acres, 625 million are softwoods, 64 percent of which is in North America. For all Free World forests under exploitation, North America has about one-third of the total timber volume and 70 percent of the softwood volume. North America's share of hardwood forest volume of the Free World on forests under exploitation is small (15 percent) and would be very much smaller if more of the hardwood timber in the other free countries, particularly in Latin America and Africa, were available.

WORLD RESOURCES

Lack of data and lack of comparability of such data as are available make it extremely difficult to compare world timber resources. Such information as is available indicates that North America

TABLE 12.—*Forest resources of North America, 1953*

Country	Total land area	Forest land area: Total forest land	Commercial: Total	Commercial: Softwood	Commercial: Hardwood	Noncommercial
	Million acres	*Million acres*	*Million acres*	*Million acres*	*Million acres*	*Million acres*
United States	1, 904	648	485	230	255	163
Alaska [1]	366	136	44	33	11	92
Canada [2]	2, 218	951	529	396	133	422
Mexico	487	64	49	16	33	15
North America	4, 975	1, 799	1, 107	675	432	692

Country	Timber volume [3]: All species	Timber volume [3]: Softwood	Timber volume [3]: Hardwood	Net annual timber growth [4]	Timber cut [4]
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*
United States	498	336	162	14. 2	10. 8
Alaska [1]	50	41	9	1. 0	([5])
Canada [2]	397	328	69	[6] 4. 5	3. 6
Mexico	59	19	40	. 5	. 7
North America	1, 004	724	280	20. 2	15. 1

[1] Combines coastal and interior Alaska.
[2] Excludes Labrador.
[3] On commercial forest land.
[4] Of growing stock on commercial forest land.
[5] Less than 0.05 billion.
[6] Questionable estimate. Growth on areas not under exploitation is probably less than on areas now being exploited. If the stands are comparable, total growth on commercial forest land would be about 6.6 billion cubic feet. If there is no net growth on unexploited areas, the total would be about 2.4 billion cubic feet. The estimate shown is halfway between these two extremes.

includes 19 percent of the world's forest area; the rest of the Free World, 59 percent; and the Soviet Bloc of nations, 22 percent (fig. 9). The softwood forest area of the world is fairly equally divided between the Free World and Soviet Bloc of nations. The Free World includes more than 90 percent of the hardwood forest area.

Only about one-third of the world's forest land area is classed as under exploitation, and timber volume estimates are available only for that portion. There are no timber volume estimates for all the world's forests.

About one-fourth of the Free World's forest area is under exploitation, whereas nearly half of the forest area in the Soviet Bloc is so classified. Roughly two-thirds of the timber volume on forest land under exploitation is in nations of the Free World and one-third in the Soviet Bloc. But with respect to softwoods, about three-fifths is in the Soviet Bloc and two-fifths in the Free World.

North America includes the bulk of softwood resources of the Free World with the Soviet Bloc and Free World nations dividing the softwood forest area about equally. The Soviet Bloc of nations has a favorable margin with regard to soft-

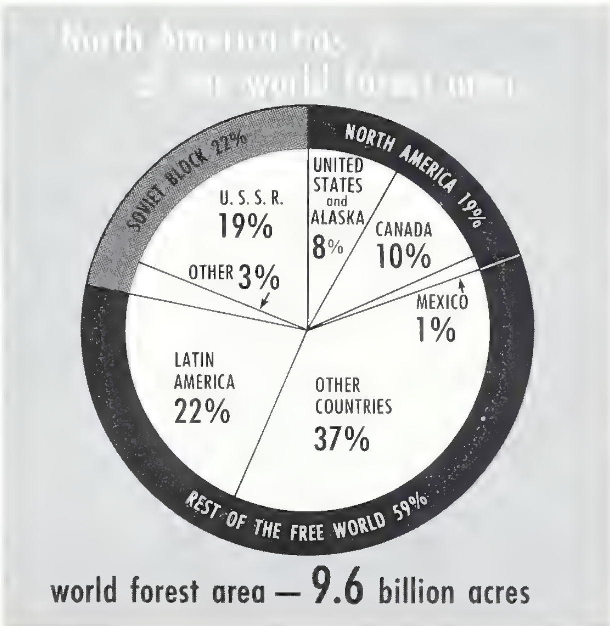


Figure 9

wood timber volumes on forests under exploitation (table 13). Free Asia, Latin America, and Africa are responsible for the fact that the great bulk of the world's hardwood timber resources are in the Free World group of nations.

The United States is intermediate among other nations with respect to softwood resources per capita. Whereas the United States' inventory shows about 10,000 board-feet of softwoods per capita, Canada has over 55,000 and the U. S. S. R. over 30,000. In contrast, France has only a little over 1,000 and the United Kingdom about 100 board-feet of softwoods per capita (table 14).

TABLE 13.—*Distribution of world forest resources, 1953* [1]

Country or region	Forested area			Timber volume [2]		
	All types	Softwood	Hardwood	All species	Softwood	Hardwood
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
North America:						
United States and Alaska	8	14	5	15	19	10
Canada [3]	10	23	4	7	10	3
Mexico	1	(4)	1	(4)	1	(4)
Total	19	37	10	22	30	13
Rest of Free World	59	11	82	42	12	77
Soviet Bloc	22	52	8	36	58	10
The world	100	100	100	100	100	100

[1] Source: *World Forest Resources*, Food and Agriculture Organization of the United Nations, Rome, 1955. Data for North America revised to agree with statistics given in other parts of this report.

[2] Of forests under exploitation. About 31 percent of the world's forests are being exploited, 39 percent in North America, 22 percent rest of Free World, and 47 percent in Soviet Bloc.

[3] Excludes Labrador.

[4] Less than 0.5 percent.

TABLE 14.—*Per capita forest land area and sawtimber inventory in selected countries*

Country	Forest land	Sawtimber [1]	
		Softwood	Hardwood
	Acres	*Thousand bd.-ft.*	*Thousand bd.-ft.*
Canada	66. 0	55. 6	8. 7
U. S. S. R.	7. 7	31. 0	6. 6
Japan	0. 7	2. 4	2. 4
Sweden	7. 9	54. 0	9. 6
United States	4. 2	10. 5	2. 6
France	0. 7	1. 1	0. 8
United Kingdom	0. 1	0. 1	0. 2
The world	3. 6	5. 2	4. 4

[1] In forests under exploitation only.

In summary, it is evident that the United States is reasonably well endowed with timber resources in relation to those of other nations of the world, if its forests are effectively managed. Proximity to Canada, the extent of Canadian resources, the Canadian potential for increased timber growth, and existing export of timber products from Canada to the United States are all favorable factors. The United States is dependent on Canada for substantial timber imports, and Canada's timber resources appear to be such that we may continue to depend on Canada for equal or greater imports in the future. The United States will continue to be a net importing nation in timber products.

The resources of Coastal Alaska are considered an integral segment of continental United States' timber resources.

There are important timber resources in Interior Alaska which, in terms of forest area and timber volumes, exceed those of Coastal Alaska or Mexico. Accessibility is the present handicap to development of Interior Alaska's forests, but ultimately they can be expected to add to the United States' timber supply. They are not sufficiently large, however, to affect the world timber picture significantly.

PRESENT TIMBER SITUATION AND IMPLICATIONS FOR THE FUTURE

The first part of this summary, after outlining necessary assumptions relating to the national economy, dealt with (a) projected future demand for timber products, and (b) United States timber resources in relation to those of the world. It was made clear that the United States will have to rely largely on domestic resources for future timber supplies. Estimates of projected demand substantially larger than current consumption

were developed. This second main part of the summary deals with the currently available supply of forest land and timber and related items. The third major part will review projected demand estimates in relation to needed and prospective growth and inventory of timber.

Forest Land

Forest land is the basic resource. The extent of forest land in relation to total land area of the United States, the proportion of forest land that is available for commercial timber production, the location of such land geographically, its ownership, its condition, the forest types represented, the degree to which it is stocked with growing trees, and the condition of the timber are all significant facts essential to an understanding of the current timber situation and its future potentialities.

One-Fourth of Nation's Land Is Commercial Forest

The total forest area is considerably larger than the area devoted to crop land, but slightly smaller than the pasture and range area. However, of the 664 million acres of forest land in the continental United States and Coastal Alaska, as of January 1, 1953, 489 million acres, or about one-fourth of the total land area of the United States, is classed as commercial forest land (fig. 10).

includes Coastal Alaska

Figure 10

Two classes of forest land are recognized, commercial and noncommercial. Both are defined in the appendix. In brief, commercial forest lands are those on which reliance must be placed for supplies of timber. These lands have other values as well as timber production. Frequently these other values such as water yield or recreational use transcend the values of the land for timber production. Noncommercial forest lands are those which are either unavailable for, or incapable of, growing commercial crops of timber. Except for occasional brief references to noncommercial forest land or the trees thereon, this report deals only with commercial forest land and timber.

Three-Fourths of Commercial Forest Land Is in the East

Of the 489 million acres of commercial forest land, it is significant that three-fourths is in the East with the greatest concentrations in the Southeast, West Gulf, and Lake States Regions (fig. 11). Such heavily industrialized and densely populated regions as the Middle Atlantic, South Atlantic, and Central Regions, each have about as much commercial forest land as does the Pacific Northwest—the region with the greatest commercial forest area in the West (fig. 12 and table 15).

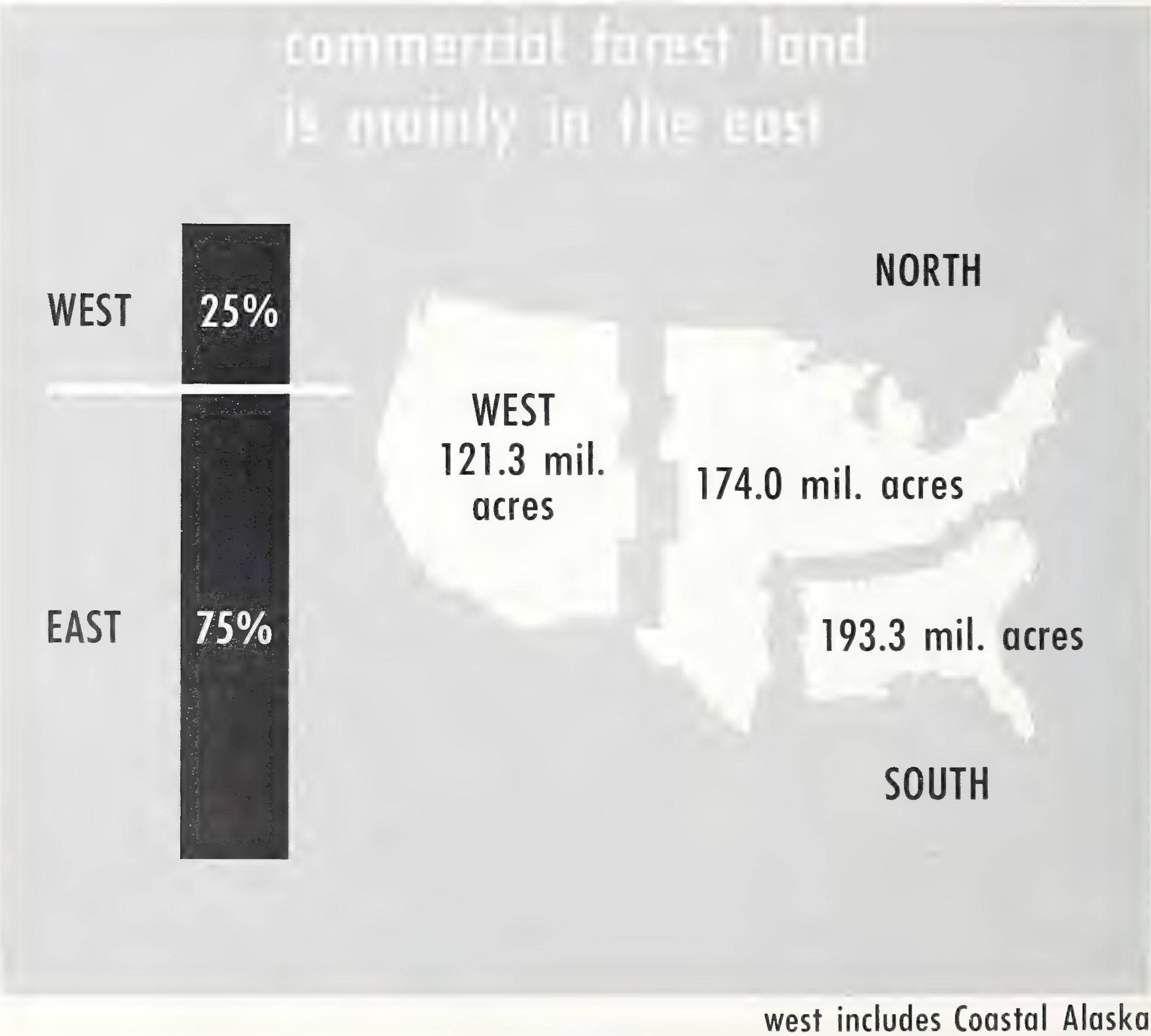


Figure 11

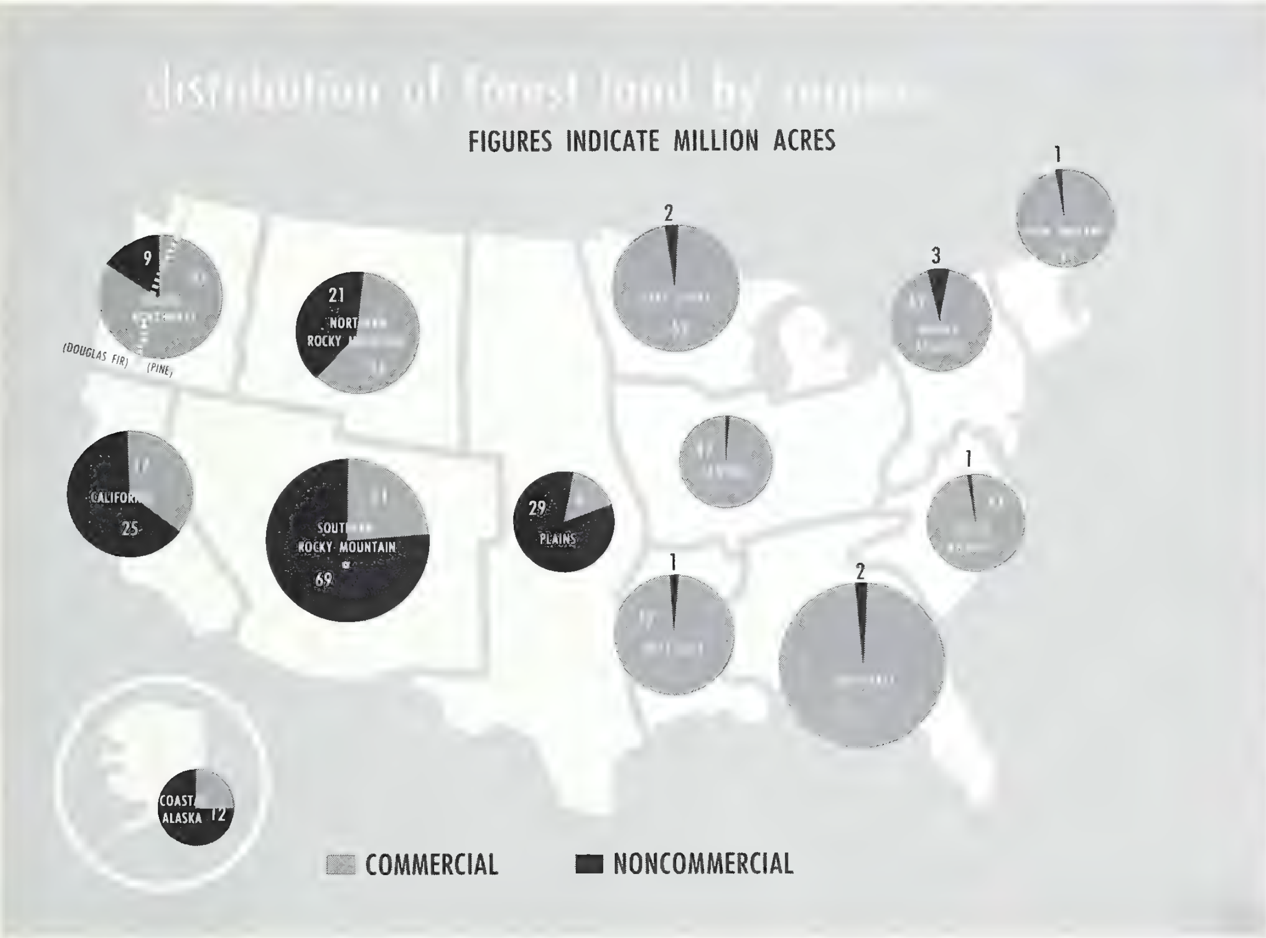


Figure 12

In addition to having the largest share of the commercial forest land, individual eastern regions also have the largest proportions of total land area that is classed as commercial forest. For example, New England has only 5 percent of the Nation's forest land, but 76 percent of the total land area of the region is commercial forest land. In contrast, only 43 percent of the total land area in the Pacific Northwest is commercial forest land, although this is the highest percentage in the West. In four eastern regions, more than half of the land area is commercial forest; 76 percent in New England, 60 percent in the South Atlantic Region, 59 percent in the Southeast, and 57 percent in the West Gulf Region.

Softwood and Hardwood Types About Equal in Area

It is significant that the total commercial forest area is almost equally divided between softwoods and hardwoods. This is important from the standpoint of what may be expected with respect to future growth and productivity from the lands. Furthermore, there is almost an equal area of softwood types in the East and in the West. Hardwood types, on the other hand, are concentrated almost exclusively in the East, where they exceed the area of softwood types by roughly two to one:

	Softwood types (million acres)	*Hardwood types (million acres)*	*Total (million acres)*
North	35. 1	138. 9	174. 0
South	81. 6	111. 7	193. 3
West and Coastal Alaska	117. 4	3. 9	121. 3
All sections	234. 1	254. 5	488. 6

Three eastern types—oak-hickory, loblolly-shortleaf pine, and oak-gum-cypress—each exceed in area the most widespread western type, which is ponderosa pine:

Major forest type groups:	Million acres	Percent
Oak-hickory (East)	112. 2	23
Loblolly-shortleaf pine (East)	58. 5	12
Oak-gum-cypress (East)	40. 3	8
Ponderosa pine (West)	37. 5	8
Maple-beech-birch (East)	33. 4	7
Douglas-fir (West)	31. 7	6
Other softwood types:		
East	58. 3	12
West	48. 2	10
Other hardwood types:		
East	64. 6	13
West	3. 9	1
All types	488. 6	100

The oak-hickory type includes nearly one-fourth of the total commercial forest land area of the Nation, and is twice as extensive as the next most widespread type, loblolly-shortleaf pine. The ponderosa and Douglas-fir types, which are the most extensive in the West, represent only 8 and 6 percent respectively of our total commercial forest land area. These type distributions are significant in that they foreshadow the probability that the timber inventory of the future will shift toward hardwoods as the eastern types are built up and as the old-growth conifers of the West are utilized. This shift will be lessened to the extent eastern hardwood types are converted to softwoods.

Three-Fourths of the Commercial Forest Area Is Privately Owned

Privately owned forest lands, and mainly those in farm and "other" private (i. e., exclusive of forest industry) ownership, hold the main key to the Nation's future timber supplies.[8] Nearly three-fourths of all commercial forest land is in private ownership, and more than four-fifths of this, or about 60 percent of the national total, is owned by farmers and the "other" private group (fig. 13).

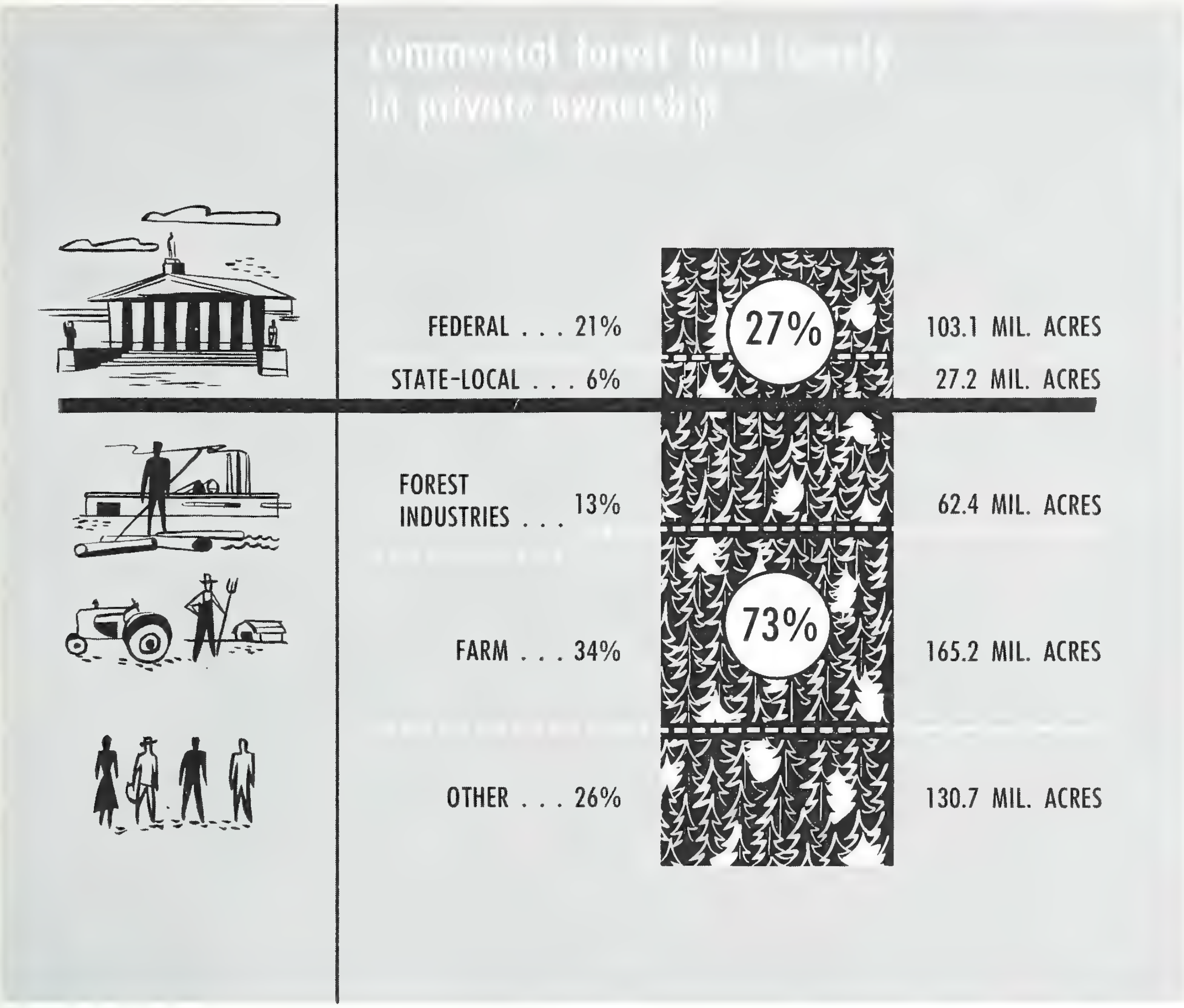
[8] The significance of ownership as a factor in future timber supplies is discussed in more detail in a latter section of this summary, and in the section on "Ownership of Forest Land and Timber." Consequently only the broad highlights relative to type of ownership, sectional distribution, and size class of ownership are presented here.

TABLE 15.—*Forest land area, 1953* [1]

Section and region	Total forest land		Commercial forest land		Noncommercial forest land	
	Million acres	*Percent*	*Million acres*	*Percent*	*Million acres*	*Percent*
North:						
New England	31. 4	5	30. 6	6	0. 8	(2)
Middle Atlantic	44. 9	7	42. 2	9	2. 7	2
Lake	55. 2	8	53. 3	11	1. 9	1
Central	42. 7	6	42. 4	9	. 3	(2)
Plains	34. 6	5	5. 5	1	29. 1	17
Total, North	208. 8	31	174. 0	36	34. 8	20
South:						
South Atlantic	47. 3	7	46. 1	9	1. 2	1
Southeast	96. 9	15	95. 0	19	1. 9	1
West Gulf	53. 1	8	52. 2	11	. 9	(2)
Total, South	197. 3	30	193. 3	39	4. 0	2
West:						
Pacific Northwest:						
Douglas-fir subregion	29. 0	4	25. 4	5	3. 6	2
Pine subregion	25. 1	4	20. 0	4	5. 1	3
Total	54. 1	8	45. 4	9	8. 7	5
California	42. 6	6	17. 3	4	25. 3	14
Northern Rocky Mountain	55. 3	8	33. 8	7	21. 5	12
Southern Rocky Mountain	89. 6	14	20. 5	4	69. 1	40
Total, West	241. 6	36	117. 0	24	124. 6	71
Continental United States	647. 7	97	484. 3	99	163. 4	93
Coastal Alaska	16. 5	3	4. 3	1	12. 2	7
All regions	664. 2	100	488. 6	100	175. 6	100

[1] Table 15 is the first in a series of four regional tables in this summary. Most tabular material is more condensed and regional data are largely confined to the individual sections or appendix. The four regional tables included in this summary are those relating to forest land (table 15), timber volumes (table 21), timber growth (table 29), and timber cut (table 32).

[2] Less than 0.5 percent.



includes Coastal Alaska

Figure 13

Public ownerships [9] account for one-fourth of all commercial forest land, with the largest concentration in the national forests. The national forests contain 17 percent of the national total (table 16).

The 23,500 forest industry owners comprise one-half of one percent of the total number of ownerships and hold 13 percent of the forest land. They are exceeded, both as to acreage owned and number of ownerships, by farm and also by "other" private ownership.

The pattern of ownership varies widely in different parts of the country. Farm ownership and other nonforest industry private ownership is concentrated in the North and in the South. Forest industry is concentrated in the South where one-half of all forest industry ownership occurs, the balance being rather equally distributed between the North and the West. Public ownership, on the other hand, is least in the South, and greatest in the West. It is of interest too that in the West farm and "other" private ownership together greatly exceed, and individually nearly equal, the area owned by forest industries. In no section of the country is forest industry the predominant ownership areawise.

The three-fourths of the commercial forest land which is in private ownership is distributed among 4.5 million owners, of whom 3.4 million, or 75 percent, are farm owners. Thus, this group is the largest single identifiable class, controlling one-third of the total commercial forest land, and making up three-fourths of the number of owners (table 17).

[9] Including lands held in trust by the Federal Government for the Indians.

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TABLE 16.—*Ownership of commercial forest land, by section, 1953*

Ownership	All sections	North	South	West and Coastal Alaska
	Million acres	*Million acres*	*Million acres*	*Million acres*
Private:				
Farm	165. 2	61. 4	90. 1	13. 7
Forest industries	62. 4	14. 1	33. 5	14. 8
Other	130. 7	66. 1	53. 0	11. 6
Total	358. 3	141. 6	176. 6	40. 1
Public:				
National forest	84. 8	10. 3	10. 4	64. 1
Other Federal	18. 3	2. 8	3. 8	11. 7
State and local	27. 2	19. 3	2. 5	5. 4
Total	130. 3	32. 4	16. 7	81. 2
All ownerships	488. 6	174. 0	193. 3	121. 3

As would be expected with an ownership pattern dominated by farmers, the size class of ownership is mainly small. One-third of the private commercial forest land is owned by 3.9 million individuals with less than 100 acres each. An additional one-fourth of the land is in some 590 thousand more ownerships of 100 to 500 acres each (fig. 14). The distribution of both privately owned commercial forest land and number of private owners is as follows:

Size of ownership in acres	*Percent of privately owned area*	*Percent of number of private owners*
50,000+	16	Negl.
5,000–50,000	10	Negl.
500–5,000	13	1
100–500	27	13
Less than 100	34	86
Total	100	100

Although farm ownerships are concentrated in units of 500 acres and less, the reverse is true in forest industry ownerships where two-thirds are in ownerships of 50,000 acres and larger. Lumber industry ownership is fairly evenly divided between ownerships in the 5,000 to 50,000 acre class and those above 50,000 acres. Pulp industry ownership is concentrated in the 50,000 acre and larger size class. The most uniform ownership distribution according to size of holding is in the "other" private group. There the concentration tends toward the small ownerships, but there is also substantial acreage in the large and very large size classes.

Sawtimber and Poletimber Stands About Equal in Area

One criterion of forest condition and a factor in future productivity is size of timber. On a na-

TABLE 17.—*Number and area of private commercial forest land ownerships in the United States and Coastal Alaska, 1953*

Ownership	Number of owners [1]	Total area	Ownership size class (acres): 50,000 and larger	5,000 to 50,000	500 to 5,000	100 to 500	Less than 100
	Thousands	*Million acres*	*Million acres*	*Million acres*	*Million acres*	*Million acres*	*Million acres*
Farm	3, 382. 5	165. 2	0. 5	4. 5	23. 2	59. 2	77. 8
Forest industry:							
Lumber	21. 3	34. 7	18. 6	10. 6	3. 1	1. 9	. 5
Pulp	. 2	23. 3	21. 8	1. 3	. 2		
Other	2. 0	4. 4	1. 6	2. 5	. 1	. 2	(2)
Total	23. 5	62. 4	42. 0	14. 4	3. 4	2. 1	. 5
Other	1, 104. 7	130. 7	15. 8	15. 8	19. 8	36. 6	42. 7
Total, private area		358. 3	58. 3	34. 7	46. 4	97. 9	121. 0
			Thousands	*Thousands*	*Thousands*	*Thousands*	*Thousands*
Total, number of owners	4, 510. 7		. 3	2. 5	46. 3	586. 5	3, 875. 1

[1] State basis. Owners holding commercial forest land in two or more States are counted more than once.

[2] Less than 0.1.

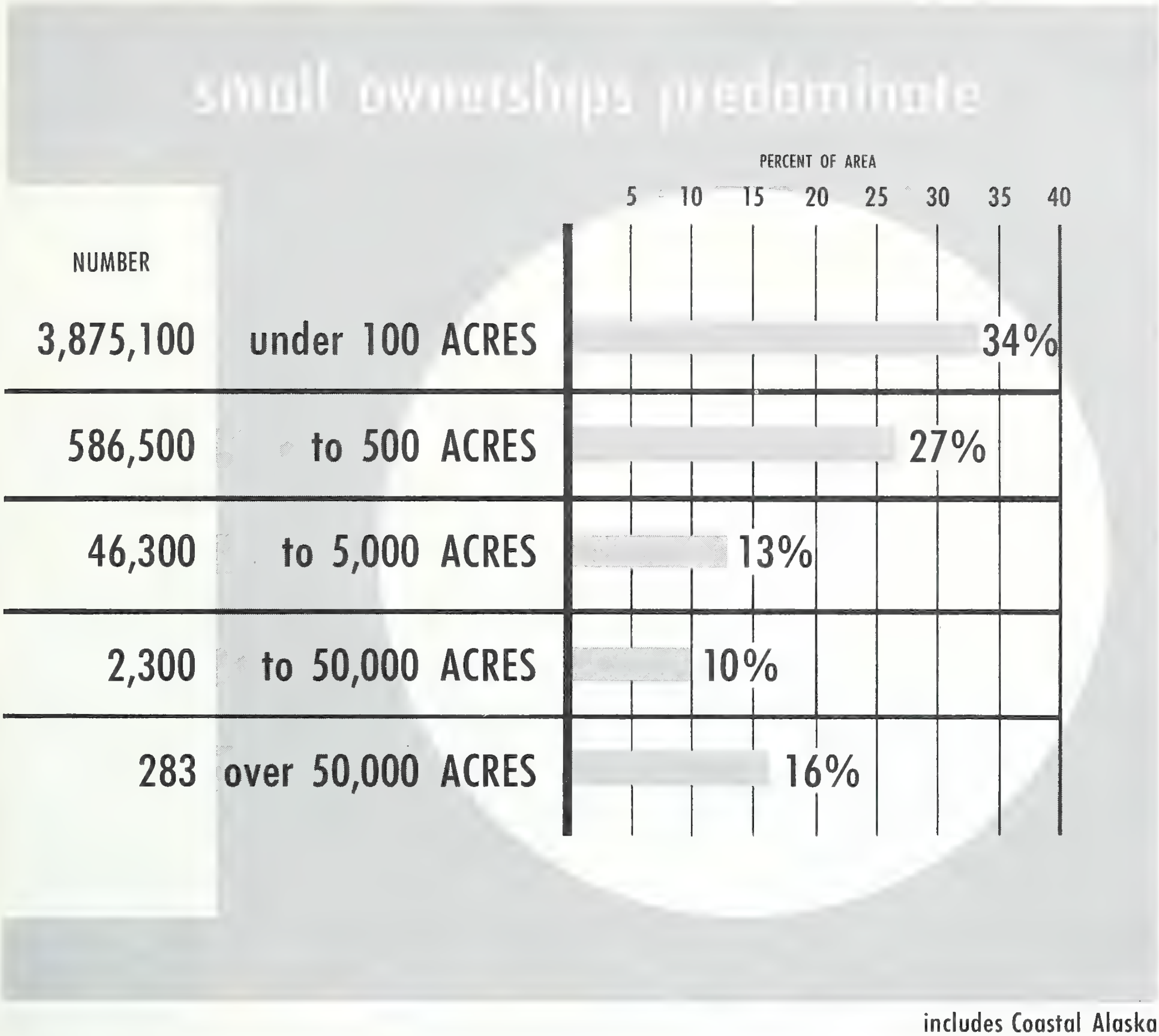


Figure 14.—Ownership of private commercial forest land.

tional basis the stand-size class distribution of timber is reasonably good. Something over one-third of the area is in sawtimber. Slightly less but still more than one-third is in stands of poletimber trees. Seedlings and saplings occupy about one-fifth of the area and nonstocked lands a little less than 10 percent.

On a sectional basis sawtimber stands predominate in the West and Coastal Alaska, mainly because of the 50 million acres of old-growth stands still present, three-fifths of which is found in the national forests. About one-tenth of all commercial forest land is still in old-growth sawtimber. Poletimber stands predominate in the North and South. The nonstocked areas of the East, about equally divided between North and South, considerably exceed the western area of either young-growth sawtimber or poletimber stands. The total nonstocked area of about 42 million acres is only a little less than the total remaining area of old-growth timber, and is presently contributing little or nothing to future timber supplies (table 18).

TABLE 18.—*Commercial forest land area, by stand-size class and section, 1953*

Stand-size class	Total		North	South	West and Coastal Alaska
	Million acres	*Percent*	*Million acres*	*Million acres*	*Million acres*
Sawtimber stands:					
Old growth	50. 0	10	(1)	(1)	50. 0
Young growth	132. 7	27	47. 7	60. 5	24. 5
Total	182. 7	37	47. 7	60. 5	74. 5
Poletimber stands	169. 5	35	65. 5	78. 4	25. 6
Seedling and sapling stands	94. 8	19	44. 2	38. 3	12. 3
Nonstocked areas	41. 6	9	16. 6	16. 1	8. 9
All classes	488. 6	100	174. 0	193. 3	121. 3

[1] Negligible.

One-Fourth of Commercial Forest Area Is Poorly Stocked or Nonstocked

In addition to the 41 million acres of commercial forest land with less than 10 percent stocking, there are 73 million acres which are 10 to 40 percent stocked. Thus a total of 26 percent of the commercial forest lands, exclusive of old-growth stands, support less than 40 percent of full stocking (table 19 and fig. 15). About 74 percent of the commercial forest land is 40 percent or more stocked. It is encouraging that nearly half of all commercial forest land is in the well-stocked category (70 percent or more). In each section of the country there is a larger acreage in the well-stocked category than in any of the other classes.

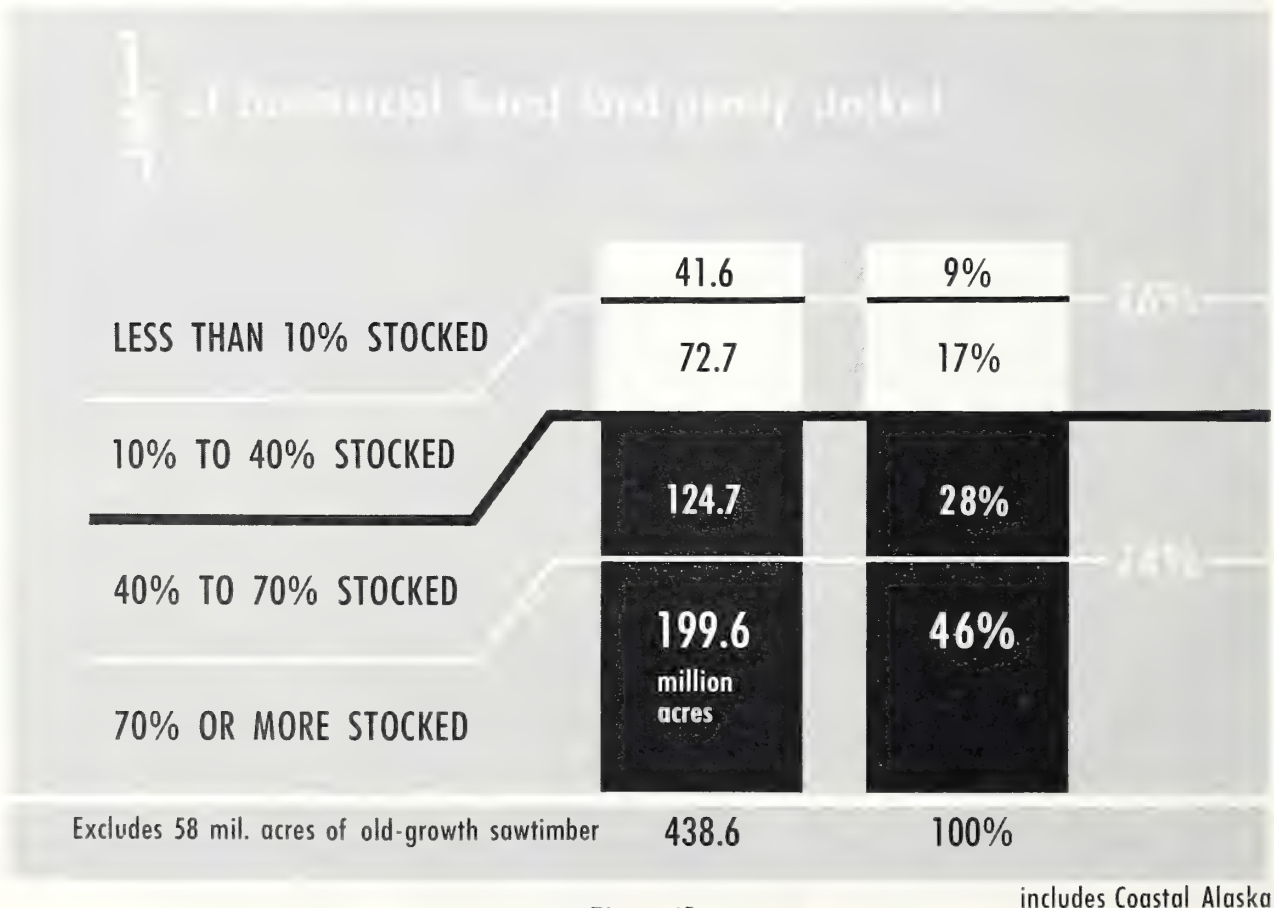


Figure 15

TABLE 19.—*Stocking of commercial forest land, 1953*

Degree of stocking	Total		North	South	West and Coastal Alaska
	Million acres	*Percent*	*Million acres*	*Million acres*	*Million acres*
70 percent or more	199. 6	46	82. 8	91. 6	25. 2
40 to 70 percent	124. 7	28	44. 0	58. 1	22. 6
10 to 40 percent	72. 7	17	30. 6	27. 5	14. 6
Less than 10 percent	41. 6	9	16. 6	16. 1	8. 9
Total	[1] 438. 6	100	174. 0	193. 3	71. 3

[1] Excluding 50 million acres of old-growth sawtimber stands.

The younger stands have more than their proportionate share of poor stocking. Whereas 12 percent of the young-growth sawtimber area is poorly stocked, 17 percent of the poletimber area and 29 percent of the seedling and sapling stands are so classified. The 69 million acres of poorly stocked seedling and sapling stands and nonstocked areas are mainly in the Southeast and Lake States. These regions account for more than half the total. This large area, which is almost equal to the sawtimber area of the West, offers one of the best possibilities for increasing timber supply (fig. 16).

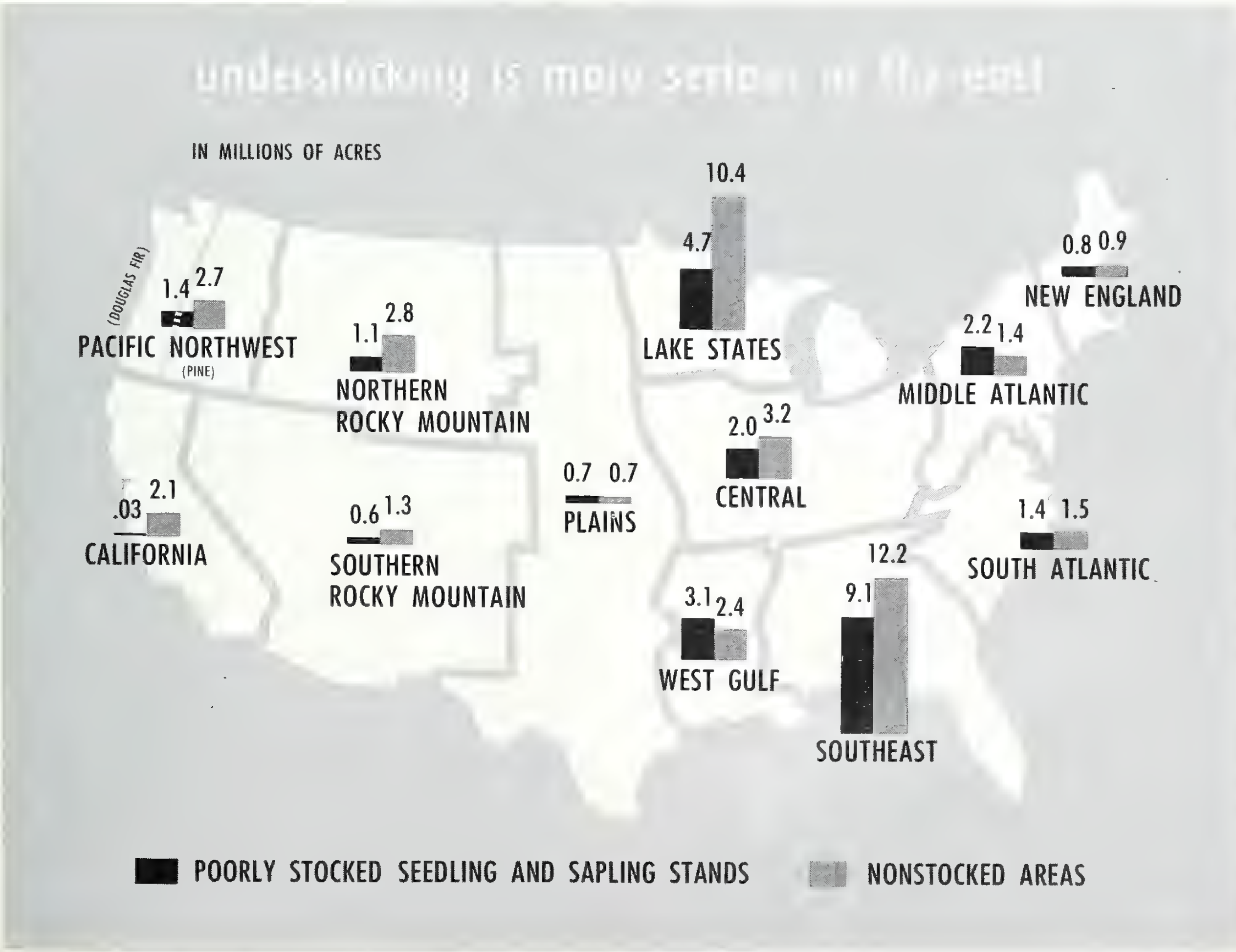


Figure 16

There Is No Excess of Commercial Forest Land

Whether there is enough land available for commercial timber production is a key question and an extremely difficult one to answer. Heretofore it has generally been accepted that there was ample forest land in the United States to meet foreseeable needs if the land were adequately "put to work." Now this no longer appears clearly evident.

If every acre of commercial forest land were managed as intensively as the better managed lands were in 1953, and if this could be achieved in the next few years, sufficient timber might be grown to nearly satisfy medium projected timber demand. If the intensity of forestry and utilization that now prevails in some European countries were to be applied in the United States, it is believed that more than enough timber could ultimately be grown to meet foreseeable needs. The current productivity of forest land in the United States is low in relation to physical capacity of the soil and climate to grow trees. On the other hand, this physical capacity is pretty much an academic concept from the standpoint of practicable attainability over large areas.

Although the long-time trend of commercial forest land area in the United States has been downward, there does not appear to have been any great change since about 1920 when the first estimate was made that compared reasonably well with present standards and concepts. The present estimate of 485 million acres in continental United States compared to the Forest Service estimate of 461 million acres made in 1945 indicates a 24-million-acre increase in commercial forest land. This is believed due to three factors: (1) Changes in land use, (2) changes in land classification, and (3) more accurate estimates. The largest addition was in the South where 10 million acres of farm land reverted to commercial forest. Substantial changes occurred in the West through reclassification of noncommercial to commercial forests; and in the North some 4 million acres of forested swamps and poor aspen sites were reclassified. On the other hand, there have been shifts in the opposite direction resulting from clearing land for reservoir sites, parks, rights-of-way, and urban uses.

It appears, however, that in view of probable increases in population, further urbanization, further development of our national highway system, needs for reservoir sites, priority use of commercial forest land for water yield and recreation, and needs for agricultural land to meet food requirements, the long-term trend and pressures will be in the direction of less area for commercial forestry purposes.

The three factors which in combination indicate that there is no excess of commercial forest land are (1) the probability that less land will be available for commercial forestry purposes in the future, (2) a projected future demand much greater than present levels of consumption, and (3) the impracticality of every acre of forest land growing timber to its full capacity. In view of these factors, it would appear that further significant withdrawals of commercial forest land for other uses should, in general, be avoided, or should be made with full realization that such withdrawals may adversely affect future timber supplies.

Noncommercial Forest Land Has Important Values

About one-fourth of the total forest land, or 175 million acres, is classed as noncommercial. All but 14 million acres, or 92 percent, is considered unproductive from the standpoint of growing commercial crops of timber. This large acreage consists of extensive woodland types, both hardwood and coniferous, alpine areas, forested swamps, chaparral lands, and steep mountainous slopes with sparse tree cover.

The 14 million acres of noncommercial lands, which are classified as productive but reserved from timber use, consist mostly of timberlands in State or national parks, wild or wilderness areas of the national forests, community watersheds, or other areas reserved from timber use. The volume of timber on such reserved areas is not known, but is small in relation to total timber volume. The productive but reserved forest land is 3 percent of the total commercial forest land area of the United States.

Over two-thirds of the noncommercial forest land is in seven States; namely, that part of Texas occurring in the Plains Region, California, and the five States of the Southern Rocky Mountain Region. Texas and California lead with over 25 million acres of noncommercial forest land apiece. The Plains, Southern Rocky Mountain, Coastal Alaska, and California Regions each have over 50 percent of their total forest land in the noncommercial classification.

Although not used for commercial timber growing, noncommercial forest lands have important values for other purposes. The recreational values of the productive but reserved timbered areas of the national forests and parks are very high; but the greatest values of the noncommercial forest lands are for watershed protection and water yield. Noncommercial lands are used extensively in the grazing of domestic livestock and afford a valuable habitat for wildlife.

The ownership of commercial and noncommercial forest land differs sharply. Whereas three-fourths of the commercial forest land is privately owned, two-thirds of the noncommercial forest land is publicly owned and nearly all of this is in Federal ownership or management.

In addition to forest land areas there are other areas that support tree growth. These include isolated forest areas of less than 1 acre in the East, or less than 10 acres in the West, tree-covered areas in thickly populated urban and suburban sections, fence rows, orchards, and roadside, streamside, and shelterbelt strips less than 120 feet wide. Also in such classification would be the areas from which forest has been removed to less than 10 percent stocking and which have been developed for grazing, agricultural, residential, and industrial or other uses. The aggregate area of these lands, which support tree growth but are not considered forest land, is probably much greater than generally realized.

Timber Volumes

The quantity of timber in the United States and the extent of forest land are the two most fundamental aspects of the forest situation. Standing timber is the basic raw material from which current supplies are drawn. Because timber grows and thus is a renewable natural resource, present timber volumes have great significance for the future. They constitute the capital to which growth is added. And because of the long-time nature of forestry, trees now growing will necessarily constitute the available supply for some time in the future.

Throughout the Timber Resource Review quantities of timber are discussed in two classes: (1) Sawtimber, or trees large enough and suitable for lumber; and (2) growing stock. The latter includes not only the sawtimber, but also trees of smaller size which meet some commercial needs but are generally too small to be made into lumber. More precise definitions are given in the appendix.

The differentiation of the sawtimber portion of the growing stock has long been followed. It is continued in the Timber Resource Review because sawtimber has been and will continue to be the backbone of the Nation's timber economy. From sawtimber in 1952 came 96 percent of the saw logs cut and 56 percent of the pulpwood. More than half of the timber cut from growing stock for fuelwood was sawtimber, and even about one-third of the fence posts. Sawtimber comprised 84 percent of the timber cut in 1952 for all products. Hence the quantity of sawtimber continues to be of prime importance.

The Nation's total inventory of timber on commercial forest land at the beginning of 1953 was 605 billion cubic feet, which included 2,094 billion board-feet of sawtimber. In addition to the usual estimates for live sawtimber and poletimber trees, estimates were also developed for cull trees, salvable dead trees, and hardwood limbs. This was done because such material is being increasingly used for commercial purposes. No estimate was prepared for conifer limbs. Likewise, no separate estimate was made of the sound cull volume in growing stock trees, because by definition the entire sound volume to measurable limits is included in the cubic-foot inventory of growing stock. The significance of this is that the cubic-foot inventory estimates of growing stock include a substantial but unknown volume of cull-quality material. Table 20 summarizes the basic overall figures on timber volumes in terms of sawtimber trees, growing stock, and various other classes.

The terms "live sawtimber" and "growing stock" as used in the Timber Resource Review are roughly comparable to the terms "sawtimber" and "all timber" as used by the Forest Service in its Reappraisal study in 1945. However, estimates for these categories are not comparable without adjustment of the 1945 estimate as subsequently explained.

TABLE 20.—*Timber volume in United States and Coastal Alaska, 1953*

Class of material	All timber	Sawtimber[1]
	Billion cu. ft.	*Billion bd.-ft.*
Growing stock:		
Live sawtimber trees:		
Sawlog portions	331	2,057
Upper stems	48	----
Total, live sawtimber	379	2,057
Live poletimber trees	138	----
Total, growing stock	517	2,057
Cull trees	56	----
Salvable dead trees	9	37
Hardwood limbs	23	----
Total, all classes	605	2,094

[1] Included in all-timber volume but also measured in board-feet.

Over Two-Thirds of Sawtimber Volume Is in the West

About 70 percent of all the live sawtimber volume is in the West, including Coastal Alaska (fig. 17). In terms of growing stock, the West has a smaller proportion (56 percent) of the total but still has well over half the timber volume:

	Area (percent)	Growing stock (percent)	Live sawtimber (percent)
North	36	22	13
South	39	22	17
West and Coastal Alaska	25	56	70
All sections	100	100	100

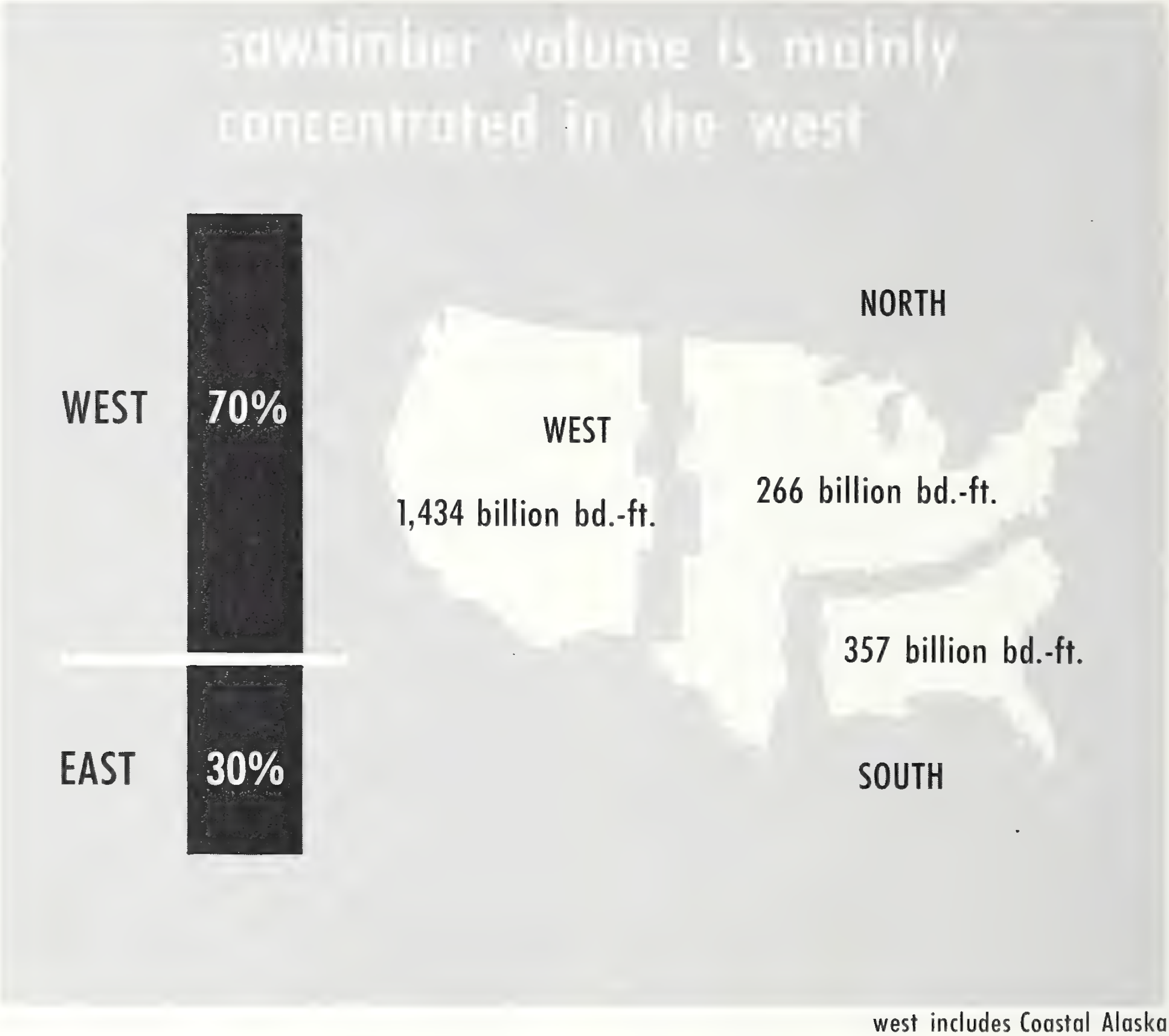
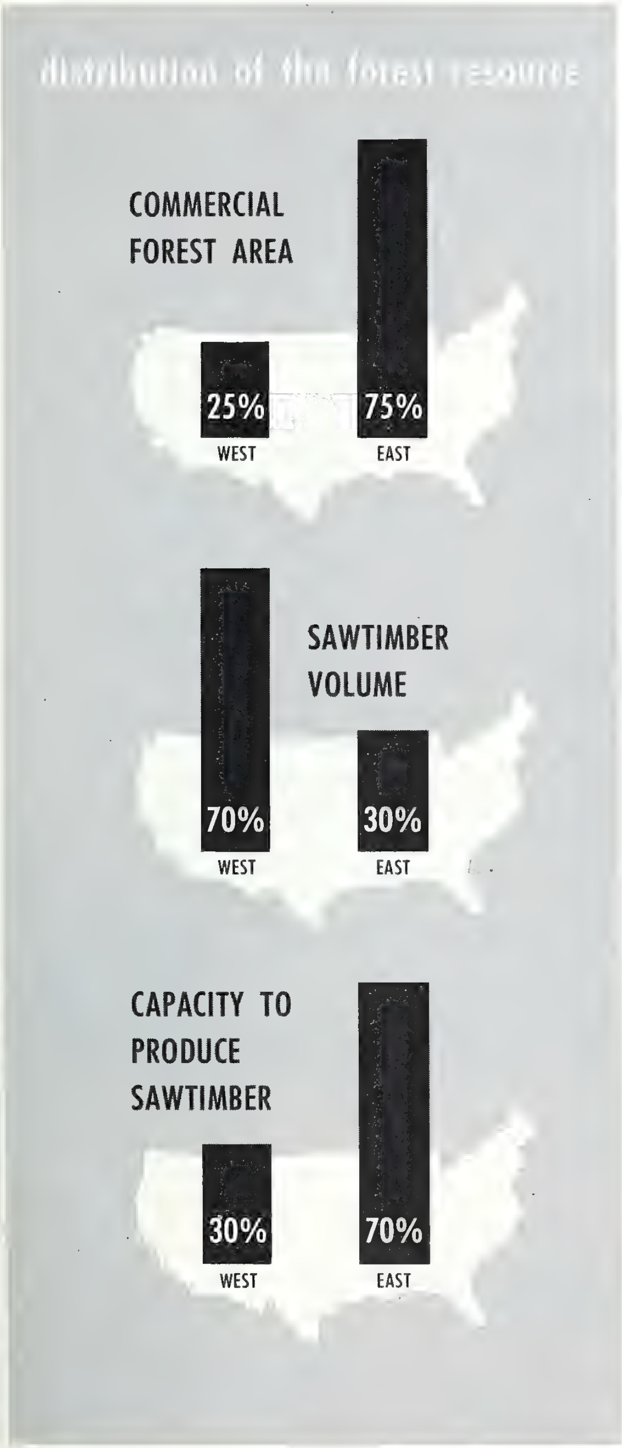


Figure 17

The distribution of timber volumes is significantly different from the distribution of forest area. The 70 percent of sawtimber volume in the West and Coastal Alaska occurs on 25 percent of the forest land, whereas the East with 75 percent of the forest land has 30 percent of the sawtimber volume. The principal reasons for this are the heavy volumes of old-growth timber on 50 million acres in the West and the generally low volumes per acre in the East. Although the West, including Coastal Alaska, now has 70 percent of the sawtimber volume, it may ultimately grow only about 30 percent of the Nation's sawtimber crop. This would be a relative decline for the West, but, in absolute terms, growing 30 percent of the Nation's sawtimber capacity would be in excess of the 1952 timber cut in the West. The estimates of capacity to grow sawtimber are based on estimates of realizable growth. They show that ultimately growth in different sections of the country will be roughly parallel to distribution of forest-land acreage (fig. 18).

Regional timber volumes are summarized in table 21. Three States, Oregon, Washington, and California, contain 54 percent of all sawtimber volume, and every western region with the exception of the southern Rocky Mountains contains more sawtimber volume than any eastern region. Coastal Alaska, on the other hand, often thought of as an important reservoir of softwood timber, has about 4 percent of the total.



west includes Coastal Alaska

Figure 18

Four-Fifths of Sawtimber Volume Is Softwood

Of the 2,057 billion board-feet of live sawtimber, 1,648 billion board-feet, or 80 percent, is softwood. In terms of growing stock, softwood comprises about two-thirds of the total.

About 85 percent of the softwood sawtimber volume occurs in the West and Coastal Alaska, whereas 93 percent of the hardwood volume occurs in the East (fig. 19). This is true despite the fact that softwood type areas are as extensive in the East as in the West. It can be expected that in the future there will be a much larger proportion of the total softwood volume occurring in the East, with relatively less in the West than is now the case.

The North is greatly deficient in softwood sawtimber volume, having only 4 percent, but it has about half of the total hardwood sawtimber volume:

	Growing stock		*Live sawtimber*	
	Softwood (percent)	*Hardwood (percent)*	*Softwood (percent)*	*Hardwood (percent)*
North	7	52	4	51
South	14	39	11	42
West and Coastal Alaska	79	7	85	7
All sections	100	100	100	100

The sectional distribution of softwood and hardwood volume in terms of growing stock is not greatly different from sawtimber distribution.

A comparison of softwood and hardwood volume distribution with distribution of softwood and hardwood types, both for the country as a whole and for each of the three main sections, shows that softwood types on the average support heavier timber volumes than do hardwood types in terms of both sawtimber and growing stock. For example, the softwood types represent 48 percent of the commercial forest area, support 80 percent of the sawtimber volume, and 69 percent of the growing stock volume (table 22).

Five Species Groups Comprise Two-Thirds of the Sawtimber Volume

Timber volumes are concentrated in a relatively few primary species, or species groups (table 23). Five such species, or groups, namely, Douglas-fir, ponderosa pine, western hemlock and Sitka spruce, western true firs, and the southern yellow pines, account for 64 percent of total live sawtimber volume. No hardwoods are included in the first five, although the sawtimber volume of the oaks, the most important hardwood group, is almost as great as that of the southern yellow pines.

Growing stock volume by species or species groups is distributed differently than sawtimber

TABLE 21.—*Timber volume by regions, 1953*

Section and region	Live sawtimber [1]			Growing stock		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Billion bd.-ft.	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*
North:						
New England	51	27	24	24	10	14
Middle Atlantic	74	13	61	34	5	29
Lake States	50	14	36	25	7	18
Central	83	4	79	25	1	24
Plains	8	1	7	3	(2)	3
Total	266	59	207	111	23	88
South:						
South Atlantic	107	51	56	34	15	19
Southeast	139	77	62	48	23	25
West Gulf	111	55	56	32	13	19
Total	357	183	174	114	51	63
West:						
Pacific Northwest:						
Douglas-fir subregion	595	577	18	113	108	5
Pine subregion	154	154	(3)	33	33	(2)
Total	749	731	18	146	141	5
California	360	354	6	66	63	3
Northern Rocky Mountain	167	166	1	43	42	[2] 1
Southern Rocky Mountain	69	66	3	18	16	2
Total	1, 345	1, 317	28	273	262	11
Continental United States	1, 968	1, 559	409	498	336	162
Coastal Alaska	89	89	(3)	19	19	(2)
All regions	2, 057	1, 648	409	517	355	162

[1] In addition to the live sawtimber volume, there are 37 billion board-feet of sawtimber in salvable dead trees; of this total 34 billion board-feet are in the West, 2 billion in the North, 1 billion in the South.

[2] Less than 0.5 billion cubic feet.

[3] Less than 0.5 billion board-feet.

volume. Douglas-fir is still first, but the oaks rank second, and the volume of southern pines is greater than the volume of ponderosa pine. Following are the five leading species or species groups in terms of percentage of sawtimber and growing stock volumes:

Species:	Sawtimber (percent)
Douglas-fir	26
Ponderosa and Jeffrey pine	11
Western hemlock and Sitka spruce	10
Western true firs	9
Southern yellow pines	8
Total	64

Species:	Growing stock (percent)
Douglas-fir	19
Oaks	10
Southern yellow pines	10
Ponderosa and Jeffrey pine	8
Western hemlock and Sitka spruce	8
Total	55

TABLE 22.—*Distribution of forest types and timber volumes, 1953*

Item	All sections	North	South	West and Coastal Alaska
	Percent	*Percent*	*Percent*	*Percent*
Commercial forest land:				
Softwood type area	48	7	17	24
Hardwood type area	52	29	22	1
Total	100	36	39	25
Growing stock:				
Softwood volume	69	5	10	54
Hardwood volume	31	17	12	2
Total	100	22	22	56
Live sawtimber:				
Softwood volume	80	3	9	68
Hardwood volume	20	10	8	2
Total	100	13	17	70

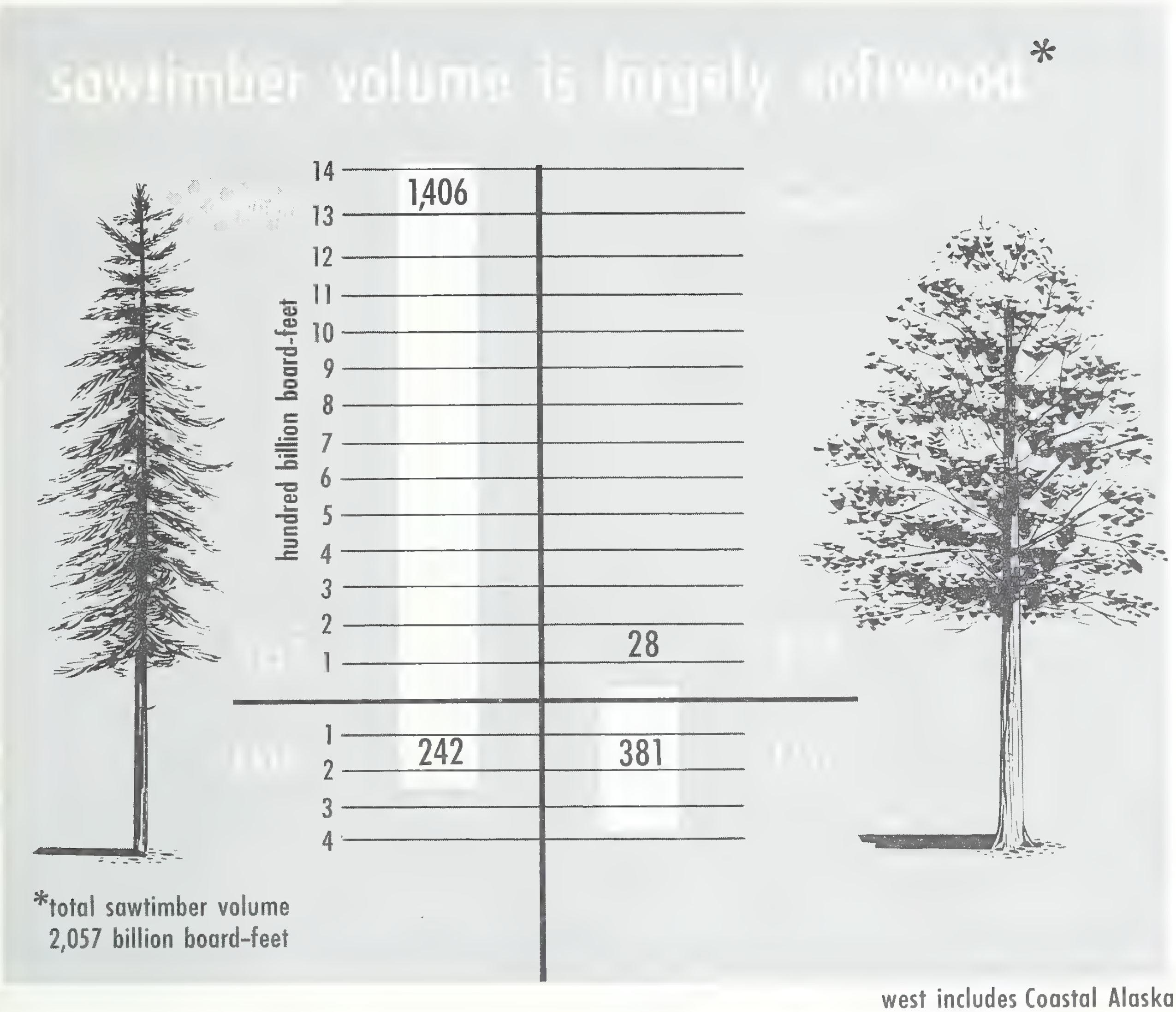


Figure 19

Sawtimber Equally Divided Between Public and Private Ownerships

Slightly more than half of the total sawtimber volume is privately owned (fig. 20). About 15 percent is in farm ownership, 37 percent in forest industry and other private, and 44 percent in Federal ownership. Unlike forest area, timber volume in forest industry ownership was not distinguished from that in other nonfarm private ownership. It is estimated, however, that forest industry ownership includes 20 to 25 percent of the live sawtimber volume, whereas the other nonfarm private ownership probably includes about 15 percent.

On a sectional basis, privately owned timber constitutes about 90 percent of the sawtimber volume in both the North and South, and is fairly equally

TABLE 23.—*Timber volume by species, in the United States and Coastal Alaska*

Species group	Growing stock	Live saw-timber
	Billion cu. ft.	*Billion bd.-ft.*
Eastern softwoods:		
Southern yellow pine	49	174
Other eastern softwoods	25	68
Total	74	242
Eastern hardwoods:		
Oak	53	146
Sugar maple, beech, yellow birch	19	51
Gums	18	51
Other eastern hardwoods	61	133
Total	151	381
Western softwoods:		
Douglas-fir	98	532
Ponderosa and Jeffrey pine	43	224
Western hemlock and Sitka spruce	43	208
True firs	38	184
Sugar and western white pine	10	57
Redwood	6	36
Other western softwoods	43	165
Total	281	1, 406
Western hardwoods	11	28
All species	517	2, 057

divided between farm, and forest industry and other private ownerships. In the West, the pattern of timber ownership is distinctly different. There half the timber volume is in national-forest ownership and three-fifths is in public ownership of all types (table 24).

Ownership differs greatly between softwoods and hardwoods (table 25). The great bulk of the hardwood sawtimber volume is in private ownership and is fairly evenly distributed between farm, and forest industry and other private ownership. On the other hand, well over half of the softwood sawtimber volume is in public ownership with farm ownership relatively unimportant. The national forests and the nonfarm private owners are the two principal groups controlling the softwood sawtimber volume.

The distribution of timber volumes among ownerships is not the same as the distribution of forest land. In the West, for example, nonfarm private ownerships control 22 percent of the commercial forest area, but 32 percent of the sawtimber volume. This means that this class of ownership in the West holds the preferred timbered areas—those with the heaviest stands per acre. National forests, on the other hand, include 53 percent of the forest area in the West and 51 percent of the timber volume. Thus, national-forest timberlands are about average for the West.

For the country as a whole, national forests have 17 percent of the commercial forest area and, due to the old-growth timber stands on western national forests, they contain 37 percent of existing sawtimber volume. Farm ownerships, on the other hand, contain 34 percent of the area but only 15 percent of the volume; and forest industry and other private 39 percent of the area, and 37 percent of the volume. Timber in farm ownership, therefore, is poorer than average for the country as a whole, and also in the South (table 26).

Timber Volume Trends

Broad generalizations comparing 1953 estimates of total timber volume in either growing stock or sawtimber with previously published estimates of national totals can only be misleading. There are numerous and complex reasons for lack of comparability between estimates, such as changing utilization standards, changing diameter limits, changing definitions of forest land, changing criteria as to commercial species, and changing standards for defect. Likewise, there have been improvements in techniques which contribute to lack of comparability. Only in the case of the 1945 Reappraisal was it possible to make adjustments that are believed to be reasonably sound.

TABLE 24.—*Ownership of live sawtimber, by section, 1953*

Ownership	All sections	North	South	West	Coastal Alaska
	Billion bd.-ft.	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*
Private:					
Farm	308	102	144	62	-------
Forest industry and other	772	132	178	462	(1)
Total	1, 080	234	322	524	(1)
Public:					
National forest	766	13	23	647	83
Other Federal	135	4	8	117	6
State and local	76	15	4	57	-------
Total	977	32	35	821	89
All ownerships	2, 057	266	357	1, 345	89

[1] Only 322,000 M bd.-ft.

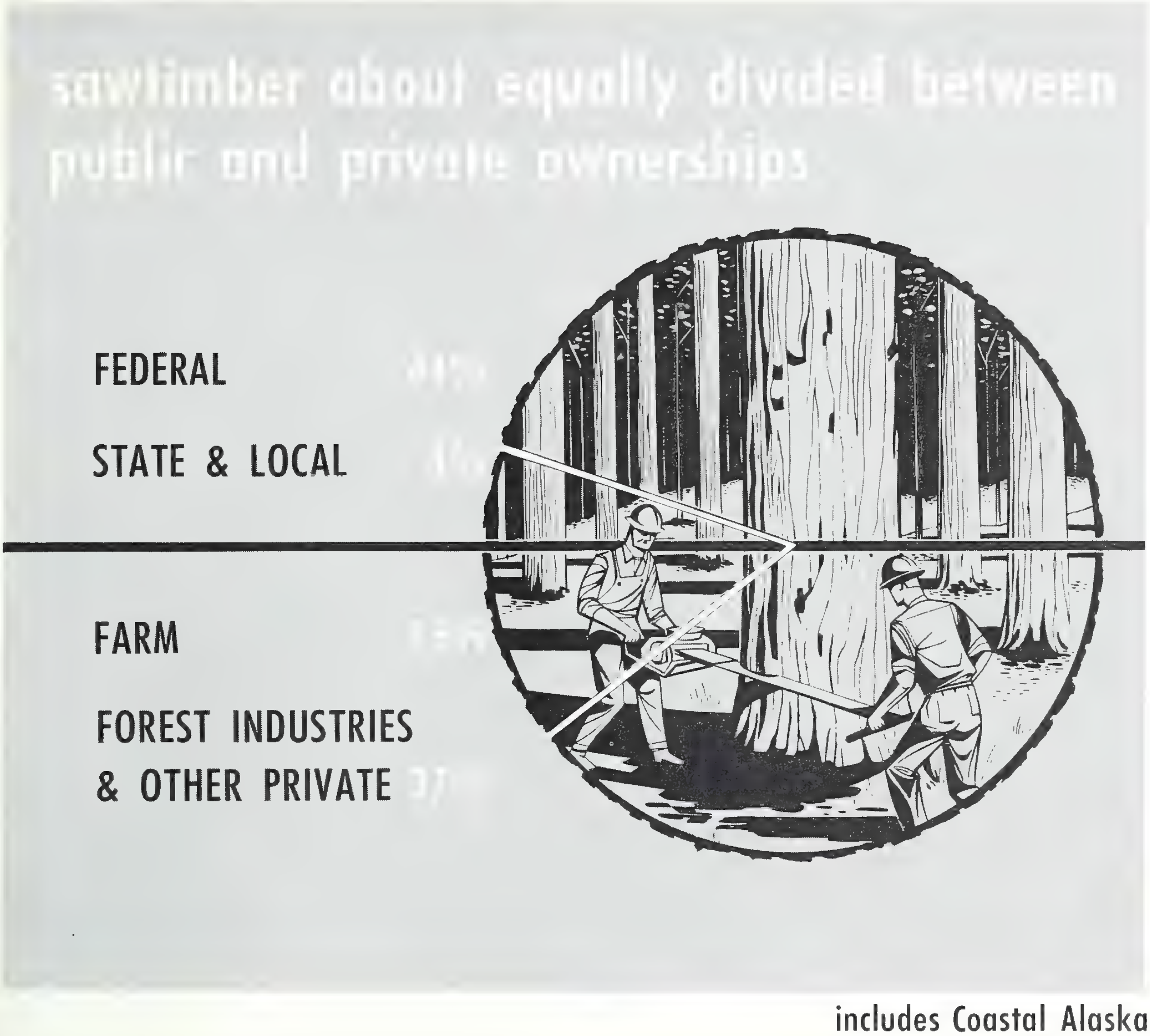


Figure 20

These adjusted estimates show an increase in growing stock from 1945 to 1953 of 8 billion cubic feet and a decrease of 38 billion board-feet of sawtimber. In each case, the overall change is about 2 percent, which is too small to indicate any significant trend.

Adjusted estimates in terms of both growing stock and live sawtimber, and in terms of eastern softwoods, eastern hardwoods, and western species are shown in table 27. Indications are that there has been about a 5-percent decrease in both sawtimber volume and growing stock volume of western species, almost exclusively softwoods. This, however, is to be expected and is not an undesirable trend. It is due to the fact that the old-growth overmature forests of the West are being harvested, and growth to replace utilized inventory cannot be expected on such lands until they are regenerated to more thrifty forests.

TABLE 25.—*Ownership of live sawtimber, by softwood and hardwood, 1953*

Ownership	Total	Soft-wood	Hard-wood
	Billion bd.-ft.	*Billion bd.-ft.*	*Billion bd.-ft.*
Private:			
Farm	308	140	168
Forest industry and other	772	579	193
Total, private	1,080	719	361
Public:			
National forest	766	740	26
Other Federal	135	127	8
State and local	76	62	14
Total, public	977	929	48
All ownerships	2,057	1,648	409

Perhaps most significant is a 9-percent increase in hardwood sawtimber volume in the East. The indicated overall softwood sawtimber decrease of 2 percent is too small to be significant, but softwood sawtimber should be increasing in the East. Although an increase in hardwood sawtimber volume is not an adverse trend, it is unfortunate if some of it is replacing the more desirable softwood. The much greater increase in eastern hardwood growing stock volume relative to sawtimber volume shows that the small-size hardwood trees are increasing at a faster rate than are the sawtimber trees.

Supplementary Sources of Timber Volumes Are Not Significant in Foreseeable Future

Past appraisals of the timber situation have been limited largely to consideration of live sawtimber volumes and growing stock on commercial forest land. Such estimates constitute the basic timber inventory, which is the source of timber growth, and to which the United States must look for the great bulk of its timber supplies.

In the Timber Resources Review, national estimates have been made for the first time of the volume of cull trees and salvable dead trees. In addition, a rough estimate has been made of wood volumes in hardwood limbs, and in the pinyon pine-juniper and hardwood types of noncommercial forest lands of the West, and of timber volumes in Interior Alaska.

Both growing stock and sawtimber volumes also occur in parks, wilderness, and other areas reserved from timber use and on nonforest areas in narrow roadside strips, fence rows, small forest acreages too small to be included in the standard inventory (less than 1 acre in the East, less than 10 acres in the West), and urbanized areas. Volumes on these areas have not been estimated, nor have volumes been estimated for conifer limbs or for bark.

Domestic timber supply sources currently or potentially available to the United States as of 1953 have been brought together in the tabulation following.

TABLE 26.—*Distribution of ownership of commercial forest area and of live sawtimber volume, 1953*

Ownership	All sections		North		South		West and Coastal Alaska	
	Area	Volume	Area	Volume	Area	Volume	Area	Volume
Private:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Farm	34	15	35	38	46	40	11	5
Forest industry and other	39	37	46	50	45	50	22	32
Total	73	52	81	88	91	90	33	37
Public:								
National forest	17	37	6	5	6	7	53	51
Other Federal	4	7	2	1	2	2	10	8
State and local	6	4	11	6	1	1	4	4
Total	27	48	19	12	9	10	67	63
All ownerships	100	100	100	100	100	100	100	100

	Estimated volume: Billion cu. ft.	Estimated volume: Billion bd.-ft.
United States and Coastal Alaska:		
Commercial forest land:		
Growing stock and live sawtimber.	517	2,057.
Cull trees including noncommercial species.	56	
Salvable dead trees	9	37.
Hardwood limbs	23	0.
Saplings	Unknown	0.
Conifer limbs	do	0.
Noncommercial forest land:		
Reserves for special uses, including State and national parks, wild and wilderness areas, and community watersheds.	Unknown but substantial.	Unknown but substantial.
Unreserved:		
Pinyon pine-juniper and hardwood types in the West.	34	Negligible.
Other unreserved forest classed as unproductive or inaccessible for timber use.	Unknown	Unknown.
Nonforest land, including tree-covered land in suburban and metropolitan areas, city parks, shelterbelts, fence rows, scattered timbered areas less than 10 acres in West and 1 acre in East, and narrow wooded strips along streams and highways.	Unknown but substantial.	Unknown but substantial.
Interior Alaska	32	180.

It is apparent that the growing-stock volume from the various supplementary sources if completely available would equal at least one-third of the growing-stock volume on commercial forest land. Cull trees alone are 10 percent of such volume. But the additional sawtimber volume, which could come only from Interior Alaska and from salvable dead trees, would add only 10 percent to the sawtimber inventory on commercial land.

Although the supplementary sources of timber enumerated above should not be overlooked, they are not particularly significant with respect to sawtimber. Moreover, with the possible exception of volumes in cull trees, dead trees, and hardwood limbs, it is most unlikely that they will enter into available timber supplies in the foreseeable future. Only under conditions of extraordinary national emergency, important changes in State and national conservation policies, or a major change in the economic availability of Interior Alaska would timber from these various supplementary sources become available.

TABLE 27.—*Comparison of timber volume in the United States,[1] 1945 and 1953*

Species groups	Growing stock			Live sawtimber		
	1945 [2]	1953	Difference	1945 [2]	1953	Difference
	Billion cu. ft.	*Billion cu. ft.*	*Percent*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Percent*
Eastern softwoods	74	74	0	247	242	−2
Eastern hardwoods	129	151	+17	351	381	+9
Western species	287	273	−5	1, 408	1, 345	−5
All species	490	498	+2	2, 006	1, 968	−2

[1] Excluding Coastal Alaska.
[2] Adjusted to 1953 basis.

It may be more practical to stretch existing timber supplies through utilization of substantial amounts now lost in logging or plant residues, through reduction of mortality, through the further reduction of fuelwood consumption and the utilization of wood now used for that purpose in other ways, and through greater reliance on imports from Canada. Volumes attributable to these items in 1952 are as follows:

	Growing stock (billion cu. ft.)	*Sawtimber (billion bd.-ft.)*
Logging residues	1. 3	2. 7
Unused plant residues	1. 4	(1)
Mortality less salvage	2. 7	9. 6
Fuelwood consumption	1. 0	2. 2
Net imports from Canada	1. 2	2. 7

[1] Sawtimber portion not segregated.

To the extent that such amounts can be utilized or find their way into other channels of consumption, or to the extent that imports can be increased, the national wood supply will be augmented.

Timber Growth and Utilization

In addition to information on forest land areas and amounts of standing timber, there are two other key characteristics of the forest situation, an understanding of which is essential not only with respect to present-day conditions but also because of their implications for the future. These are the rates at which forests are growing and are being utilized. Growth is especially significant in that this characteristic of continuous replacement differentiates timber from other physical-structure raw material resources which are nonrenewable.

Also of special significance is sawtimber growth and cut in contrast to growing stock. About 84 percent of the timber cut is sawtimber and, even with generous allowance for improved utilization, future use will continue to be heavily weighted to sawtimber. For these reasons, greater emphasis is given to sawtimber in the subsequent summary.

In appraising timber growth and timber utilization or cut, care should be taken not to overemphasize or misuse broadly generalized growth-cut balances. There is a popular tendency to believe that if overall national comparisons indicate that growth exceeds cut, the forest situation is favorable, and if cut exceeds growth, the reverse is true. Neither conclusion is justified. Significant comparisons of growth and cut are the relationships by species, or by softwoods and hardwoods, or by certain regions. Even here care must be taken not to confuse growth-cut ratios based on old-growth timber with those for second growth, or ratios for growing stock with those for sawtimber, nor to overlook the level at which the balance or unbalance may occur. Erroneous use of growth-cut relationships is the most frequent misinterpretation of findings of the Timber Resource Review.

Growth Is Increasing

Timber growth as used in the Timber Resource Review is *net* growth, which means growth after deductions for mortality. In this respect it differs from the growth estimates in the 1945 Reappraisal report of the Forest Service which used *gross* growth or growth before deductions were made for mortality. The 1944 estimates are also not directly comparable because of changing inventory standards over the years. For this and other reasons, the 1944 estimates have been adjusted in the subsequent discussion to permit reasonably valid comparisons with 1952. Annual growth includes the growth of timber on hand at the beginning of the year plus the total volume of young timber that becomes measurable during the year (commonly referred to as "ingrowth").

As in the Reappraisal, growth estimates apply to the year preceding the date of inventory. The inventory estimates were made as of January 1, 1953, but they are referred to as "1953" estimates. The growth period is the calendar year 1952.

Growth Up 9 Percent Since 1944

It is significant and reassuring that sawtimber growth in 1952 was apparently 9 percent greater than the adjusted 1944 level (table 28 and fig. 21). The change is even more significant in the second growth of the East. Here softwood and hardwood sawtimber growth increased 11 and 16 percent, respectively, over 1944. The percentage increases in growing-stock growth were somewhat more pronounced.

In the West, indications are that sawtimber growth decreased 3 percent between 1944 and 1952, and growing-stock growth showed a 2-percent decline. As old-growth areas in the West are cut and second-growth stands reach measurable size, western growth should substantially increase. Considering the large areas of second growth in the West, it would be expected that western growth would be greater in 1952 than in 1944. A probable explanation of the decrease is unusually high mortality due to bark beetle attacks in the Northern Rockies, and premature cutting of second-growth timber mainly on small private ownerships in the Northwest.

Mortality of timber by causative agents, importance, and geographical occurrence is subsequently discussed in this summary and also in the section on Forest Protection. Total mortality (without reference to amounts salvaged) is shown near the bottom of table 29, where it is apparent that mortality is equivalent to about 25 percent of net growth of both sawtimber and growing stock, and is much higher in softwoods than in hardwoods. If mortality could be substantially reduced, it would be one of the most effective measures to extend the available supply of timber.

One-Half of the Nation's Timber Growth Is in the South

The South leads the Nation in growth of both sawtimber and growing stock. Likewise, it leads both West and North in softwood growth, and lags only slightly behind the North in growth of hardwoods. Of the national total of 47.4 billion board-feet of sawtimber growth in 1952, 51 percent occurred in the South. Over 20 percent occurred in the Southeast region alone—almost equal to the sawtimber growth in the entire West (table 29). In terms of growing stock, with a national total of 14.2 billion cubic feet, the South grew 48 percent or 6.8 billion. Growth in the West continues to be held down by the large residual of old-growth timber which has little net growth.

Sixty percent of all sawtimber growth in the South is softwoods, as well as half of all growing-stock growth. Only in the North do hardwoods dominate the growth picture and there nearly four-fifths of the sawtimber growth is in hardwoods.

TABLE 28.—*Comparison of timber growth in the continental United States, 1944 and 1952*

Species group	Growing stock			Live sawtimber		
	1944 [1]	1952	Change from 1944	1944 [1]	1952	Change from 1944
	Billion cu. ft.	*Billion cu. ft.*	*Percent*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Percent*
Eastern softwoods	3. 8	4. 4	+16	15. 2	17. 0	+11
Eastern hardwoods	5. 9	7. 1	+20	16. 6	19. 1	+16
Western species	2. 8	2. 7	−2	11. 6	11. 2	−3
All species	12. 5	14. 2	+14	43. 4	47. 3	+9

[1] Adjusted to 1952 basis.

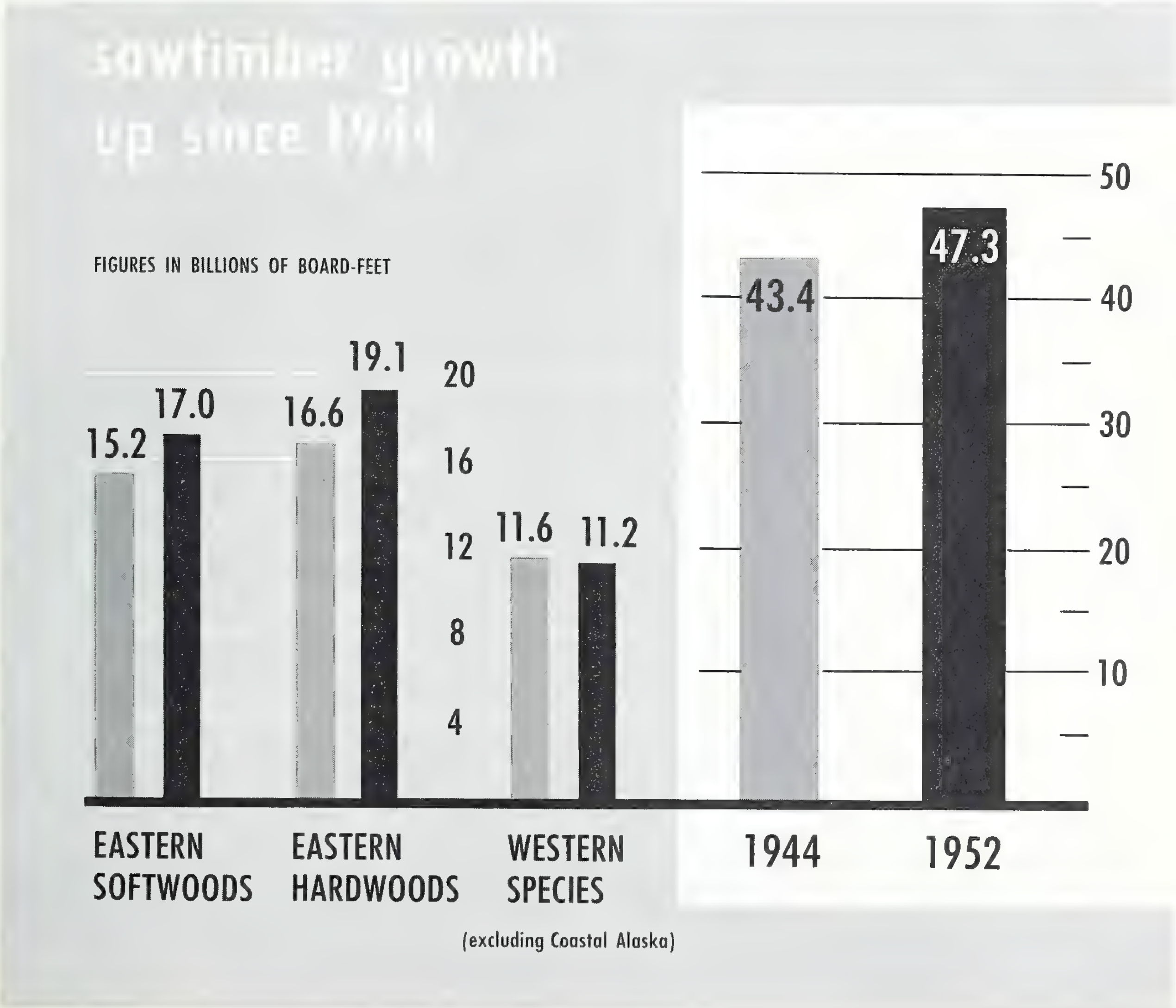


Figure 21

TABLE 29.—*Net annual growth of timber on commercial forest land by regions, 1952*

Section and region	Growing stock			Live sawtimber		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*
North:						
New England	0.88	0.29	0.59	1.86	0.91	0.95
Middle Atlantic	1.35	.15	1.20	3.16	.47	2.69
Lake States	1.18	.32	.86	2.69	.80	1.89
Central	1.13	.05	1.08	3.96	.25	3.71
Plains	.12	.01	.11	.40	.04	.36
Total, North	4.66	.82	3.84	12.07	2.47	9.60
South:						
South Atlantic	1.91	.97	.94	6.88	3.67	3.21
Southeast	3.06	1.72	1.34	10.04	6.68	3.36
West Gulf	1.84	.88	.96	7.10	4.15	2.95
Total, South	6.81	3.57	3.24	24.02	14.50	9.52
West:						
Pacific Northwest:						
Douglas-fir subregion	1.00	.94	.06	5.15	5.01	.14
Pine subregion	.33	.33	(1)	.83	.82	.01
Total	1.33	1.27	.06	5.98	5.83	.15
California	.59	.54	.05	2.94	2.89	.05
Northern Rocky Mountain	.60	.59	.01	1.53	1.51	.02
Southern Rocky Mountain	.22	.19	.03	.73	.68	.05
Total, West	2.74	2.59	.15	11.18	10.91	.27
Continental United States	14.21	6.98	7.23	47.27	27.88	19.39
Coastal Alaska	.03	.03	(1)	.13	.13	(1)
All regions	14.24	7.01	7.23	47.40	28.01	19.39
Mortality,[2] all regions	3.49	2.24	1.25	12.52	10.09	2.43
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Mortality in relation to net growth	25	32	17	26	36	13

[1] Less than 0.005.

[2] These estimates represent the current level of mortality indicated by trends over a period of years, as determined in 1952. The estimates of mortality in 1952 shown subsequently in the protection discussion in this section are the same except in the West. The 1952 mortality in the West is higher by 0.02 billion cubic feet of growing stock and 0.15 billion board-feet of sawtimber than used in these periodic estimates because of abnormally high 1952 mortality in the Northern Rocky Mountain region.

One-Third of Sawtimber Growth Is Southern Yellow Pine

The growth of southern yellow pines as a group in 1952 was 14.2 billion board-feet, or about 30 percent of total sawtimber growth (table 30). The growth of southern pines so dominated the sawtimber growth picture that it exceeded the growth of all other softwoods combined, both eastern and western, and was not far behind the combined growth of all hardwoods. Douglas-fir dominated the growth of western softwoods, and the oaks accounted for nearly 40 percent of sawtimber growth of eastern hardwoods.

The distribution of sawtimber growth among hardwood species is significant. Five of the more desirable hardwoods—white oak, red oak, yellow birch, sugar maple, and yellow-poplar—accounted for less than 30 percent of eastern hardwood growth. A group of other hardwoods, increasingly used for pulpwood, accounted for an additional 30 percent. Much of the remaining 40 percent of hardwood sawtimber growth is in less desirable species.

In terms of growing-stock growth, the southern yellow pines again dominated the picture and accounted for one-fourth of the total. They are exceeded, however, by a miscellaneous group of eastern hardwoods which include many of the less desirable species.

TABLE 30.—*Growth and cut by species group, 1952*

Species group	Growing stock			Live sawtimber		
	Growth	Cut	Ratio of growth to cut [1]	Growth	Cut	Ratio of growth to cut [1]
	Billion cu. ft.	*Billion cu. ft.*		*Billion bd.-ft.*	*Billion bd.-ft.*	
Eastern softwoods:						
Southern yellow pine	3. 48	3. 03	1. 15	14. 15	11. 61	1. 22
White, red, and jack pine	. 27	. 26	1. 05	. 91	. 97	. 93
Spruce and balsam fir	. 29	. 24	1. 20	. 74	. 67	1. 11
Other eastern softwoods	. 34	. 22	1. 57	1. 17	. 84	1. 39
Total	4. 38	3. 75	1. 17	16. 97	14. 09	1. 20
Eastern hardwoods:						
Oak	2. 48	1. 29	1. 92	7. 32	4. 89	1. 49
Sugar maple, beech, yellow birch	. 72	. 33	2. 21	1. 88	1. 29	1. 46
Other hard hardwoods	1. 30	. 36	3. 65	2. 93	1. 15	2. 56
Yellow-poplar	. 29	. 22	1. 33	. 95	. 99	. 96
Other soft hardwoods	2. 29	1. 05	2. 17	6. 04	3. 89	1. 55
Total	7. 08	3. 25	2. 18	19. 12	12. 21	1. 57
Western softwoods:						
Douglas-fir	. 90	1. 97	. 46	4. 43	11. 96	. 37
Ponderosa and Jeffrey pine	. 48	. 60	. 79	1. 84	3. 60	. 51
Western white and sugar pine	. 10	. 10	1. 03	. 53	. 61	. 88
Redwood	. 08	. 16	. 47	. 40	. 99	. 40
Other western softwoods	1. 07	. 91	1. 18	3. 84	5. 30	. 72
Total	2. 63	3. 74	. 70	11. 04	22. 46	. 49
Western hardwoods	. 15	. 02	6. 48	. 27	. 08	3. 31

[1] Ratios computed before rounding.

Cut Is Mainly Softwood Sawtimber

Timber cut is the term used to describe the volume of standing timber that is cut for various timber products or destroyed in logging whether removed from the woods or left unused. It includes, therefore, logging residues and is equivalent to "commodity drain" as used in the 1945 Reappraisal.

Of the 10.8 billion cubic feet of growing stock cut for timber products, 1.7 billion was cut from poletimber. This means that 84 percent was cut from sawtimber-size trees, and demonstrates how heavily the cut leans to the larger size sawtimber (fig. 22). Whereas 84 percent of the cut is from sawtimber, only 73 percent of the total inventory is in sawtimber. This means a trend toward smaller size trees.

The flow of timber products from growing stock to end product in 1952 is graphically illustrated in figure 23, which shows the growing stock input from both East and West, the amount from cull and dead trees, and net imports, as well as losses due to logging and plant residues, and the final products.

Three-Fourths of Sawtimber Cut Is for Saw Logs

Of the 48.8 billion board-feet of live sawtimber cut in 1952, an estimated 36.6 billion feet, or 75 percent, was utilized for saw logs. The next largest volume, or slightly under 10 percent of the total, was for pulpwood. Four principal items, saw logs, pulpwood, veneer logs and bolts, and fuelwood, accounted for about 95 percent of sawtimber cut (table 31).

Three-Fourths of Sawtimber Cut Is Softwood

About 36.6 billion board-feet, or 75 percent of total sawtimber cut in 1952, was softwood. Softwood likewise comprised about the same percentage of total growing stock cut (table 31). Softwoods accounted for practically the entire cut in the West. In the South about three-fifths of the cut was softwoods, but in the North the cut of hardwoods predominated in both sawtimber and growing stock.

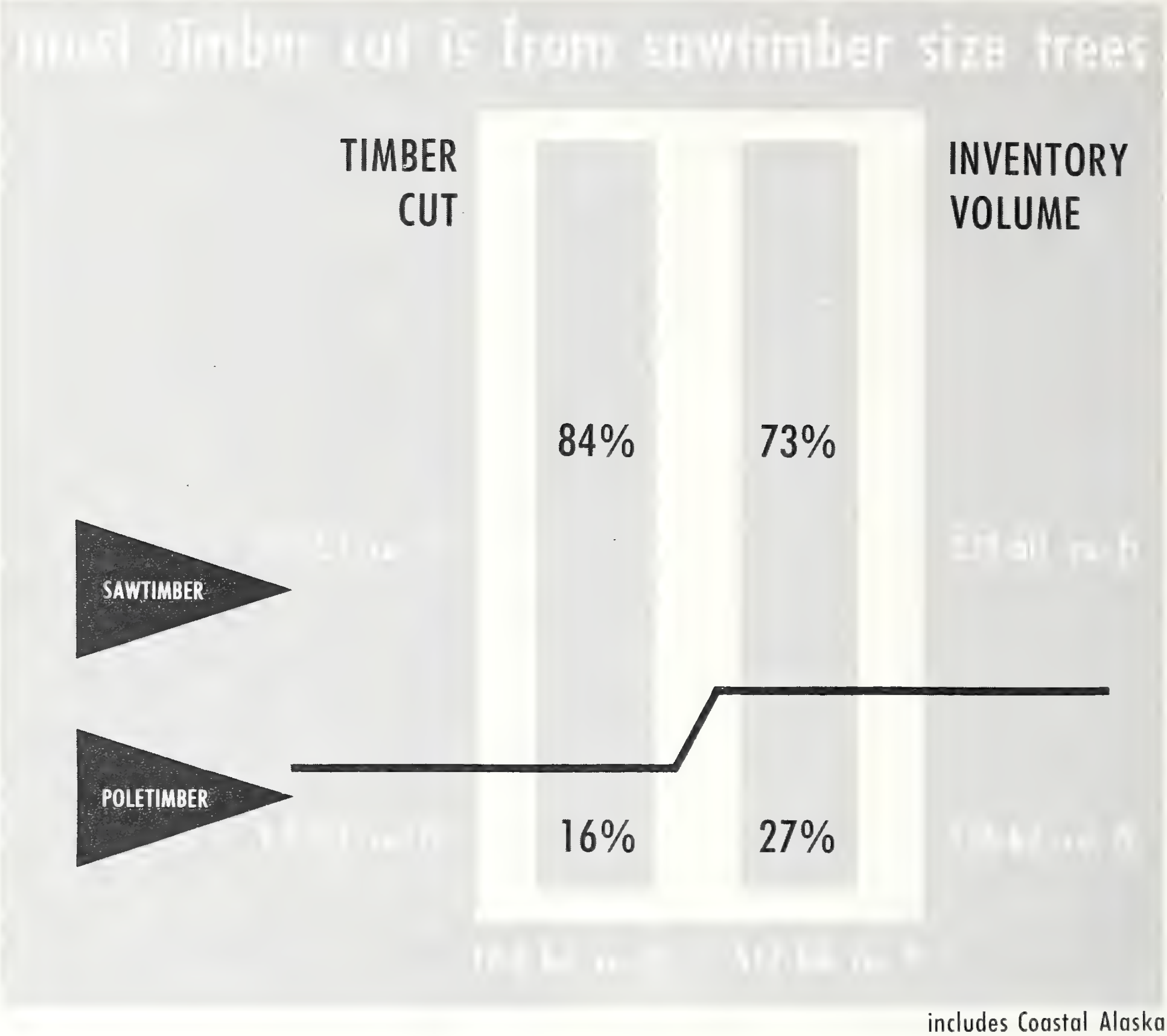


Figure 22

Nearly Half the Sawtimber Cut Comes From the West

In 1952, about 22.5 billion board-feet of sawtimber was cut in the West, excluding Coastal Alaska, or about 46 percent of the national total. In terms of growing stock, the South produced close to half of the total, the West produced about one-third (table 32).

It is also significant that between 1944 and 1952 the West was providing an increasing proportion of the total cut (table 33). Although there was no significant difference in the total cut of sawtimber between the two years, the sawtimber cut in the West rose 20 percent, reflecting mainly an increase in California where cut more than doubled in the interim. In contrast, the sawtimber cut of eastern softwoods dropped 17 percent and eastern hardwoods 13 percent between

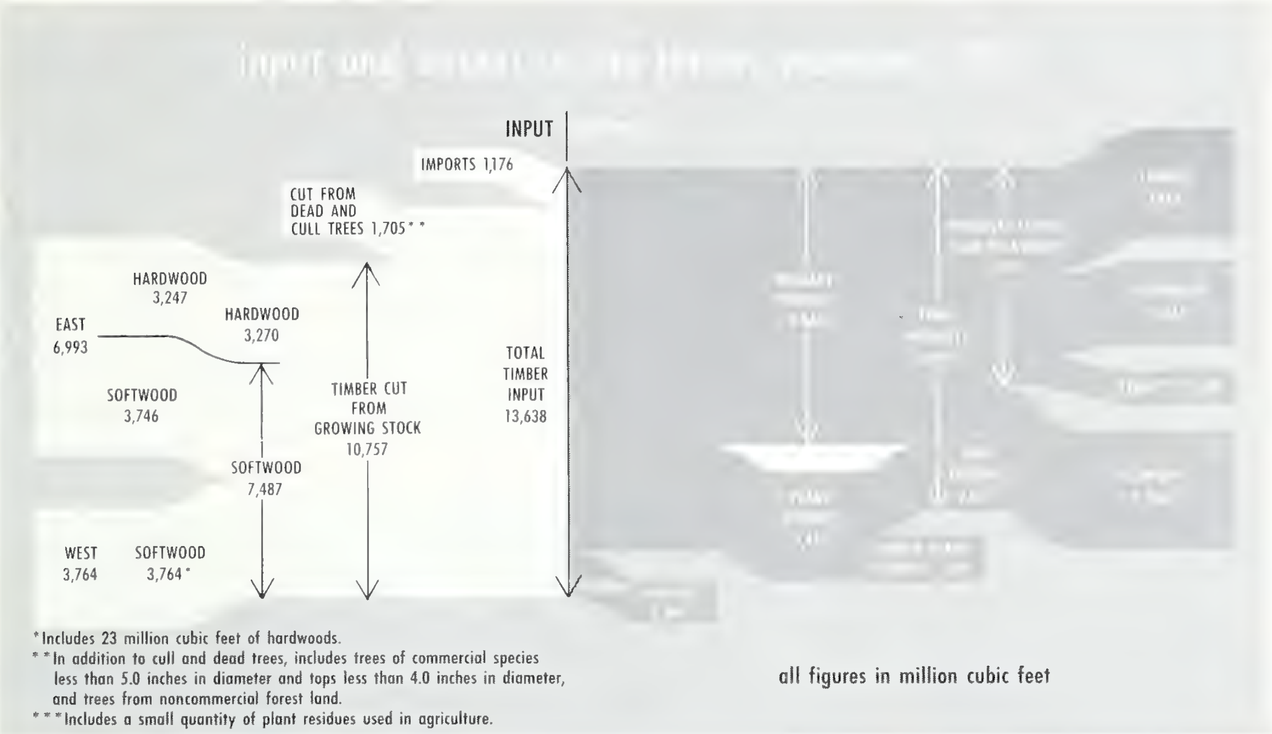


Figure 23

TABLE 31.—*Timber cut on commercial forest land, 1952*

Products	Growing stock			Live sawtimber		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*
Saw logs	6. 82	5. 21	1. 61	36. 64	28. 89	7. 75
Veneer logs and bolts	. 49	. 25	. 24	2. 80	1. 57	1. 23
Cooperage logs and bolts	. 10	. 03	. 07	. 51	. 14	. 37
Pulpwood	1. 73	1. 46	. 27	4. 69	4. 25	. 44
Fuelwood	1. 01	. 25	. 76	2. 25	. 60	1. 65
Piling	. 03	. 03	(1)	. 16	. 15	. 01
Poles	. 10	. 10	(1)	. 47	. 47	(1)
Posts	. 13	. 05	. 08	. 22	. 07	. 15
Hewn ties	. 11	. 03	. 08	. 48	. 15	. 33
Round mine timbers	. 08	. 02	. 06	. 10	. 04	. 06
Other	. 16	. 06	. 10	. 52	. 22	. 30
All products	10. 76	7. 49	3. 27	48. 84	36. 55	12. 29

[1] Less than 0.005.

1944 and 1952. This increased dependence on the West will not be continued indefinitely. The trend will be reversed as western old growth is cut over and as cut is more nearly related to forest area and growth capacities of the land. The decreases in the sawtimber cut of eastern softwoods and eastern hardwoods may explain in part the increases in the timber growth of those species groups (table 28). Likewise the increase in cut of western species may explain in part the decrease in growth of those species as shown in the same table.

TABLE 32.—*Timber cut by region, 1952*

Section and region	Growing stock			Live sawtimber		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*
North:						
New England	0. 50	0. 36	0. 14	1. 76	1. 38	0. 38
Middle Atlantic	. 47	. 13	. 34	1. 80	. 51	1. 29
Lake States	. 54	. 19	. 35	1. 24	. 38	. 86
Central	. 40	. 02	. 38	1. 81	. 09	1. 72
Plains	. 03	(1)	. 03	. 09	. 01	. 08
Total, North	1. 94	. 70	1. 24	6. 70	2. 37	4. 33
South:						
South Atlantic	1. 46	. 92	. 54	5. 35	3. 36	1. 99
Southeast	2. 41	1. 48	. 93	9. 41	5. 72	3. 69
West Gulf	1. 19	. 65	. 54	4. 84	2. 64	2. 20
Total, South	5. 06	3. 05	2. 01	19. 60	11. 72	7. 88
West:						
Pacific Northwest:						
Douglas-fir subregion	2. 03	2. 02	. 01	12. 22	12. 17	. 05
Pine subregion	. 36	. 36	(1)	2. 05	2. 05	(1)
Total	2. 39	2. 38	. 01	14. 27	14. 22	. 05
California	. 93	. 92	. 01	5. 72	5. 70	. 02
Northern Rocky Mountain	. 33	. 33	(1)	1. 90	1. 90	(1)
Southern Rocky Mountain	. 10	. 10	(1)	. 56	. 55	. 01
Total, West	3. 75	3. 73	. 02	22. 45	22. 37	. 08
Continental United States	10. 75	7. 48	3. 27	48. 75	36. 46	12. 29
Coastal Alaska	. 01	. 01		. 09	. 09	
All regions	10. 76	7. 49	3. 27	48. 84	36. 55	12. 29

[1] Less than 0.005.

TABLE 33.—*Comparison of timber cut in continental United States, 1944 and 1952*

Species group	Growing stock			Live sawtimber		
	1944	1952	Change from 1944	1944	1952	Change from 1944
	Billion cu. ft.	*Billion cu. ft.*	*Percent*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Percent*
Eastern softwoods	4. 1	3. 8	−7	16. 9	14. 1	−17
Eastern hardwoods	4. 2	3. 2	−24	14. 0	12. 2	−13
Western species	3. 4	3. 8	+12	18. 8	22. 5	+20
All species	11. 7	10. 8	−9	49. 7	48. 8	−2

One-Fourth of Timber Cut Not Utilized But Utilization Is Improving

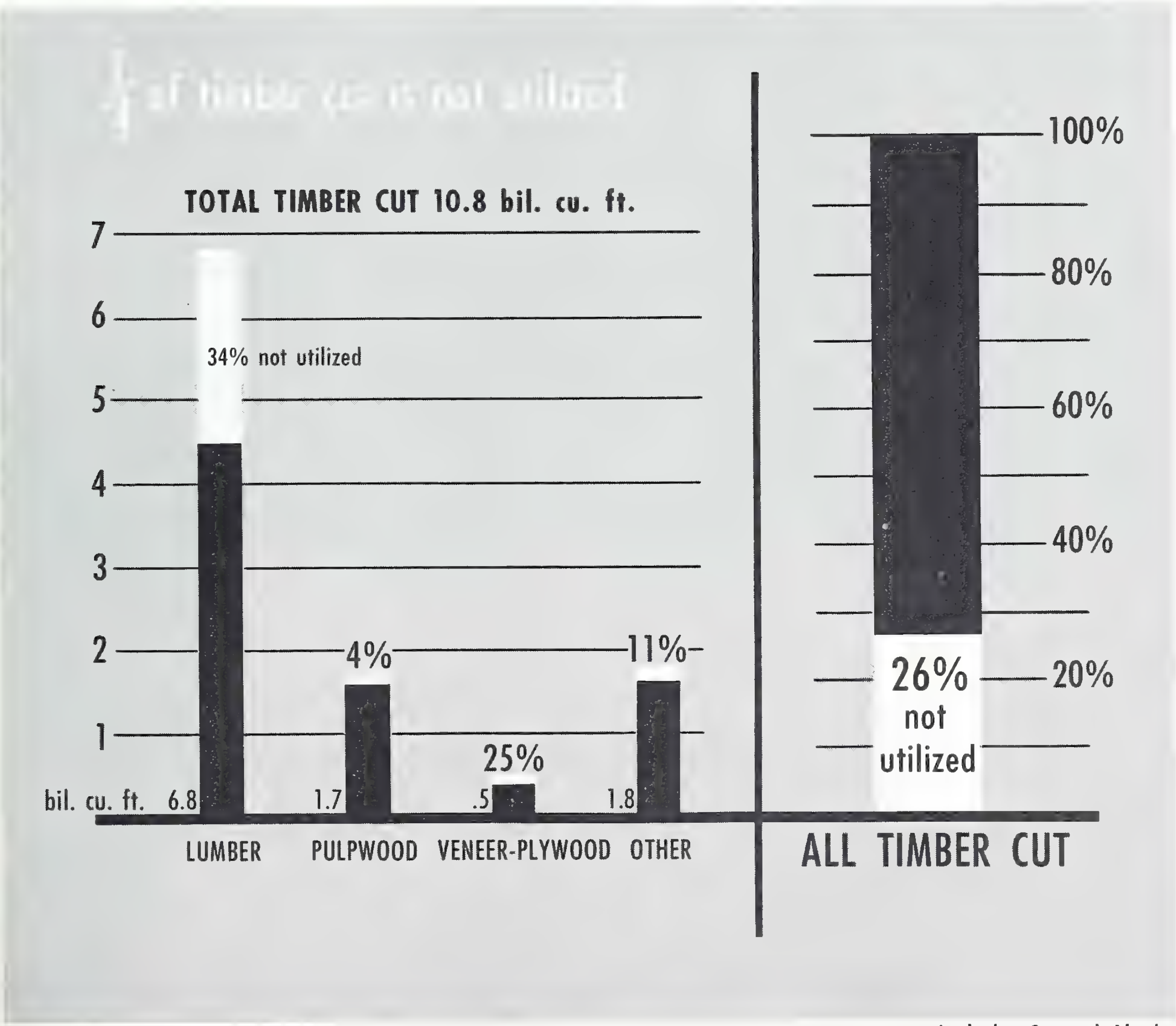
Of the total timber cut or available from other sources in 1952, about one foot out of every four, or 2.7 billion cubic feet, was not utilized (table 34). This is comprised almost equally of unused plant residues and of logging residues. By definition, logging residues include only the growing stock cut or killed in logging that does not find its way into some use. Such material that is initially left on the ground but subsequently used in salvage logging, or logging for another product, is not included in logging residues. One-third of the

timber cut for lumber is unused, but only 4 percent of that cut for pulp [10] (fig. 24). About the same proportion (28 and 26 percent) of timber cut is unused in both the South and the West, but the North with 18 percent unused would appear to have significantly closer utilization.

Logging and unused plant residues can, of course, never be completely eliminated. However, reduction in residues is one effective way of meeting increased needs for timber products and making local timber supplies go further. Reduction in the loss rate for lumber of 34 percent affords the greatest opportunity to stretch supplies, because of both the high rate and the large quantity of material involved.

In recent years much progress has been made in more efficient use of wood and more can be expected. Better equipment has been developed in both the woods and the manufacturing plants. Likewise, new techniques and processes, both chemical and structural, new uses, and new products have all been developed. Inferior species are being used more and with greater effectiveness. The outlook is for a continuation of these trends. It is estimated that by 1975 about 5 percent less sawtimber will be needed than now for a given level of products as the result of continued im-

[10] The percentage for pulp refers to logging residues only. Plant residues, consisting of wood losses in storage and in preparing the wood for pulping, amounting to about 7.5 percent of the roundwood volume, are used as fuel. Not included as residues are the additional losses of wood substance incurred in the various pulping processes, of which about 80 percent are used as fuel or for a variety of byproducts.



includes Coastal Alaska

Figure 24

TABLE 34.—*Total residues, 1952*

Source	Plant residues: Used	Plant residues: Unused	Logging residues	Unused residues: Total	Unused residues: Relation to timber cut
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Percent*
Lumber	1, 619	1, 331	1, 020	2, 351	[1] 34
Veneer	180	25	100	125	25
Cooperage	27	13	33	46	44
Pulp	170		72	72	4
Other [2]	36	13	139	152	9
Total	2, 032	1, 382	1, 364	2, 746	[1] 26
North	328	143	212	355	18
South	758	716	706	1, 422	28
West and Coastal Alaska	946	523	446	969	[1] 26
Total	2, 032	1, 382	1, 364	2, 746	[1] 26

[1] These percents may be 1 or 2 percent high because plant residues include amounts from not only domestic timber cut but also foreign and nongrowing-stock sources.
[2] Includes shingle mills, box board, small dimension, turnery, and excelsior plants, and other similar establishments utilizing roundwood.

provement in utilization. The availability of 2.7 million cubic feet of unused wood residue offers a tremendous opportunity to our research and industrial agencies.

Growth, Cut, and Volume Relations Summarized

For ready comparisons of the more significant facts on timber volumes with those on growth and cut, three summaries follow which show the relative importance of: (1) Hardwoods and softwoods in terms of forest area, sawtimber volume, growth and cut; (2) East and West in the same terms; and (3) the five principal species or species groups, in terms of volume, growth, and cut.

The hardwood forest types, which cover about half the commercial forest area, support only 20 percent of the sawtimber volume, supply 41 percent of the growth but only 25 percent of the cut. Conversely, the softwood types, likewise covering about half the commercial forest area, support 80 percent of the sawtimber volume but furnish only 59 percent of the growth while yielding 75 percent of the cut:

	Softwood (percent)	*Hardwood (percent)*
Forest types on commercial forest land	52	48
Live sawtimber volume	80	20
Net annual growth of sawtimber	59	41
Annual cut of sawtimber	75	25

On an East-West breakdown, the East has 75 percent of the forest area but supports only 30 percent of the volume. Its growth is 76 percent of the total, yet it yields only 54 percent of the total cut. Conversely, the West has one-fourth of the area and one-fourth of the growth, but it has 70 percent of the volume and almost half the cut:

	East (percent)	*West and Coastal Alaska (percent)*
Commercial forest area	75	25
Live sawtimber volume	30	70
Net annual growth of sawtimber	76	24
Annual cut of sawtimber	54	46

Five of the leading species or species groups, in terms of both growing stock and sawtimber volume, are Douglas-fir, ponderosa and Jeffrey pines, western true firs, southern yellow pines, and the oaks. These account for 61 percent of the sawtimber volume and growth and 68 percent of the cut. Variations between species, however, are of most significance. The southern yellow pines with only 8 percent of the live sawtimber volume supply 24 percent of the cut and 30 percent of the growth, whereas Douglas-fir with one-fourth of the volume and one-fourth of the cut represents about one-tenth of the growth (table 35 and fig. 25).

In terms of growing stock, southern yellow pines with 9 percent of the volume account for about a quarter of both the growth and the cut. The oaks with 10 percent of the volume account for 12 percent of the cut and 17 percent of the growth.

It is apparent from these comparisons, and others that can be drawn from table 35, that a

TABLE 35.—*Comparison of volume, growth, and cut by principal species groups, 1952*

LIVE SAWTIMBER

Species group	Volume	Growth	Cut
	Percent	*Percent*	*Percent*
Douglas-fir	26	9	24
Ponderosa and Jeffrey pines	11	4	7
Western true firs	9	3	3
Southern yellow pines	8	30	24
Oaks	7	15	10
Total	61	61	68

GROWING STOCK

Species group	Volume	Growth	Cut
	Percent	*Percent*	*Percent*
Douglas-fir	19	6	18
Oaks	10	17	12
Southern yellow pines	9	24	28
Ponderosa and Jeffrey pines	8	3	6
Western true firs	7	2	2
Total	53	52	66

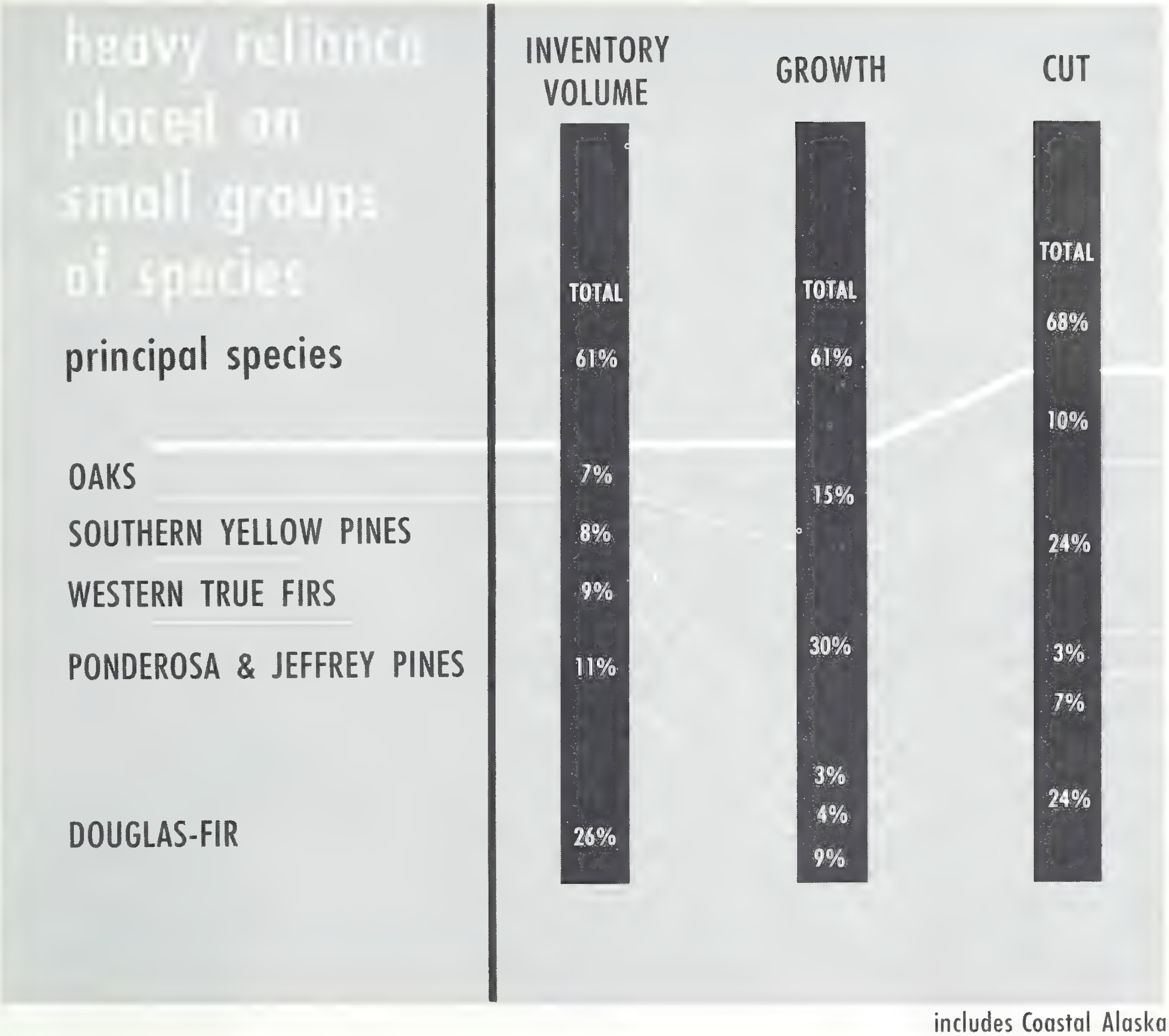


Figure 25

small group of species constitute the foundation of our timber supplies. It is also apparent that, in terms of both sawtimber and growing stock, these species together represent a greater proportion of total cut than they do of either growth or volume.

Overall Growth-Cut Comparisons Have Little Significance

One of the most natural comparisons to make in attempting to appraise in simplified terms the complex timber situation is to determine whether growth exceeds, or is less than, cut. Total growth has been compared frequently with total cut in the past by interested groups including the Forest Service, but this is gross oversimplification and unless carefully qualified and explained may well mislead the reader or conceal important relations.

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There are four main reasons why an overall growth-cut relationship has relatively little significance:

(1) The mature old-growth forests of the West are still being cut. These forests show little net growth, but heavy volumes. Until these old-growth areas are harvested and replaced by new second-growth forests, it can be expected that cut will continue to exceed growth in the West. To incorporate this unusual growth-cut relationship into overall national figures would be inappropriate.

(2) Growth-cut relationships between hardwoods and softwoods are significantly different

and softwood and hardwood species are not generally interchangeable in their merchantability and utility. In overall comparisons adverse softwood relationships may be overbalanced by favorable hardwood relationships, thus concealing softwood deficits.

(3) Equally important or perhaps more important than whether growth exceeds, or is less than, cut is the level at which such relationship occurs. In other words, a balance between growth and cut at 1952 levels is of little significance if future requirements will bring a demand for cut (and growth to meet it) at much higher levels. To carry the illustration to an extreme, there would be a balance between growth and cut if there were no growth and no cut. A balance is not significant unless it is at a sufficiently high level to meet the country's needs. As is shown later, growth needs to increase greatly over present levels in order to meet projected demand.

(4) Growth-cut relationships are frequently different depending on whether they are expressed in terms of sawtimber or growing stock. Usually growing-stock growth-cut ratios are more favorable than those for sawtimber. In other words, growth-cut ratios are better when merchantable trees of all sizes are considered than when consideration is given only to the larger and generally higher quality trees. So long as most of the cut comes from sawtimber (84 percent), whereas growth is more equally distributed among the large and the small trees, the tendency is for timber to decline in average size. In this situation, an excess of growing-stock growth over cut will appear when sawtimber growth and cut are no more than in balance. If sawtimber ratios are favorable, growing-stock ratios are likely to be even more so; but a favorable growing-stock ratio may be misleading if the sawtimber relations are not also considered. That is why growth-cut information for sawtimber is more significant than that for growing stock.

In view of the above qualifications, the more significant growth-cut comparisons—although all are deficient with respect to the question of whether they are at adequate levels—are those pertaining to eastern softwood and eastern hardwood sawtimber, and by these groups for the North and the South. Growth-cut ratios for western species have little meaning.

Softwood Growth Exceeds Cut in the East

The most significant of all growth-cut relationships is that growth of eastern softwood sawtimber exceeded cut in 1952 by 20 percent (table 30 and fig. 26). In the North, the plus margin for softwood sawtimber was 4 percent, in the South 24 percent (table 36). These favorable balances are tempered by the realization that they were achieved as much by the 17-percent reduction in cut of eastern softwoods since 1944 as by the 11-percent increase in growth (tables 28 and 33). Much of the eastern softwood sawtimber growth and cut is on small trees. The favorable balance is encouraging, but it needs to be maintained or increased until better stocking is achieved, until the East can assume a greater share of total demand, and until growth is much nearer the productive capacity of the land. Growth is far below capacity at the present time.

Eastern hardwood growth exceeded cut of sawtimber by 57 percent. As would be expected, the more preferred hardwoods in general have less favorable ratios than the less desired species.

TABLE 36.—*Growth and cut by softwood and hardwood, and by section, 1952*

Species group and section	Growing stock			Live sawtimber		
	Growth	Cut	Ratio of growth to cut [1]	Growth	Cut	Ratio of growth to cut [1]
	Billion cu. ft.	*Billion cu. ft.*		*Billion bd.-ft.*	*Billion bd.-ft.*	
Softwood:						
North	0.82	0.70	1.17	2.47	2.37	1.04
South	3.56	3.05	1.17	14.50	11.72	1.24
West and Coastal Alaska	2.63	3.74	.70	11.04	22.46	.49
Total	7.01	7.49	.93	28.01	36.55	.77
Hardwood:						
North	3.84	1.24	3.10	9.60	4.33	2.21
South	3.24	2.01	1.62	9.52	7.88	1.21
West and Coastal Alaska	.15	.02	6.48	.27	.08	3.31
Total	7.23	3.27	2.21	19.39	12.29	1.58

[1] Ratios computed before rounding.

Figure 26

In the West, the situation is quite different and, in terms of sawtimber, growth is only about half of cut, but as previously emphasized this is due to the residual of old-growth timber in the West and recent increases in the rate of timber cut.

Most Eastern Species Have Favorable Growth-Cut Ratios

Among eastern softwoods, the major species groups have favorable sawtimber growth-cut ratios except the white, red, and jack pine group. The southern yellow pines, which, of course, dominate the eastern picture, show growth to be 22 percent in excess of cut of sawtimber. Among the eastern hardwoods, yellow-poplar has an adverse sawtimber ratio. But for other "soft" hardwoods, growth exceeds cut by more than 50 percent. For a group of so-called "other 'hard' hardwoods"—which includes many relatively undesirable species—growth is two and one-half times cut. These differences point to declining quality with respect to future timber supply in terms of species composition. The ratio of growth to cut for the various species groups is as follows: [11]

[11] See table 30 for the growth and cut estimates from which these ratios are computed.

Species group:	*Saw-timber*	*Growing stock*
East:		
Spruce and fir	1.11	1.20
White, red, and jack pine	.93	1.05
Southern yellow pines	1.22	1.15
Other eastern softwoods	1.39	1.57
Yellow-poplar	.96	1.33
Other "soft" hardwoods	1.55	2.17
Oak	1.49	1.92
Sugar maple, beech, and yellow birch	1.46	2.21
Other "hard" hardwoods	2.56	3.65
West:		
Douglas-fir	.37	.46
Ponderosa and Jeffrey pine	.51	.79
Western hemlock	.47	.63
White and sugar pine	.88	1.03
Redwood	.40	.47
Other western softwoods	.91	1.56
Western hardwoods	3.31	6.48

Growth-Cut Ratios Have Improved in the Past Decade

One of the most favorable features of growth-cut comparisons with respect to future outlook is the apparent improvement of growth-cut ratios of both eastern softwoods and hardwoods since 1944. When 1944 estimates are adjusted so as to be comparable to those of 1952, they show that in 1944 growth of eastern softwood sawtimber was 90 percent of cut in contrast to the 20 percent excess over cut in 1952 (table 37).

Similarly, eastern hardwoods showed an excess of sawtimber growth over cut of 19 percent in 1944 in contrast to 57 percent in 1952. The improvement for both softwoods and hardwoods in the East resulted from the combined effect of increased growth and reduced cut.

TABLE 37.—*Comparison of sawtimber growth and cut in continental United States, 1944 and 1952*

Species group	1944 [1]		1952	
	Billion bd.-ft.	Ratio of growth to cut	Billion bd.-ft.	Ratio of growth to cut
Eastern softwoods:				
Growth	15.2	0.90	17.0	1.20
Cut	16.9		14.1	
Western softwoods:				
Growth	11.3	.60	10.9	.49
Cut	18.7		22.4	
Eastern hardwoods:				
Growth	16.6	1.19	19.1	1.57
Cut	14.0		12.2	

[1] Adjusted to 1952 basis.

In western softwoods, the trend has been in the opposite direction and, whereas growth of sawtimber was 60 percent of cut in 1944, it dropped to 49 percent of cut in 1952. This trend is explained by the 20-percent increase in cut of western species since 1944, and an apparent 3-percent decrease in growth due chiefly to premature cutting of second-growth softwood timber on small private ownerships in the Pacific Northwest and abnormally heavy insect losses in the Northern Rocky Mountain Region in 1952.

TIMBER QUALITY

The need for high-quality timber is difficult to appraise. Better grades of lumber and other quality products are in great demand, have no adequate substitutes for certain important uses, and command premium prices. As quality timber in terms of large-size, straight, fine-textured, knot-free logs becomes scarcer, there have been important developments in technology which have in part made up for the growing deficiency in this class of material. New processes and equipment permit utilization of smaller, poorer logs for both lumber and veneer, mask or correct many defects, increase the service life, and improve the all-round utility of wood. A good deal of progress has been made, and will probably be continued, toward better and closer utilization of lumber by gluing short narrow pieces into larger members, laminating techniques, and in combining lumber with other materials to improve properties and performance of fabricated products. These and other products of technology should not be minimized in appraising the future need for quality.

There are many criteria of timber quality, ranging from crude indicators to precise determinations based on the requirements of a specific product or end use. No single, all-inclusive measure of quality is possible, because of the wide variety of products made from wood. In general, a high-quality tree is one with a high proportion of its volume suitable for conversion into the higher grades of the more valuable end products and with enough volume of that character to economically justify such use.

Size of tree is one crude measure of quality. Log grades, the prevalence of cull trees, amount of sound cull volume in growing stock, and species are all indications of quality. There is relatively little nationwide quantitative information on quality, but there are numerous spot indicators which, in the aggregate, point conclusively to a decline in quality of standing timber.

Nearly 10 percent of the sound timber volume in the United States is in cull trees. The proportion is even higher in hardwoods. In addition, there is an undetermined volume of sound cull material in growing stock that has little practical use because of roughness or poor form. Although some of the cull trees are being used for pulpwood in the East, their suitability for saw logs is extremely limited. Moreover, they are utilizing valuable growing space and represent one of the reasons why so much of the forest land does not rate higher stocking.

Low-Quality Wood Predominates in Hardwood Stands

Cull is particularly important as a factor in the poor quality of the hardwood stands of the East. This is emphasized by the fact that cull hardwood trees are equivalent in volume to one-fourth of the entire hardwood growing stock. In the South the ratio is one-third, and in the southeastern region the sound volume in cull trees is equal to 42 percent of the volume of the hardwood growing stock.

Log grades are relatively good indications of quality in that they predict yields of lumber by grade with reasonable accuracy. Studies based on three-fourths of the total hardwood sawtimber volume in the East indicate that two-thirds of the net volume when inventoried by log grades would qualify only as relatively poor Grade 3 logs. Twenty percent would fall in the Grade 2 medium category, and 13 percent in the good Grade 1 category.

The overall quality of hardwood stands, based on the combined net volume of sawtimber and the sound volume of hardwoods in cull trees, is shown in figure 27. There is no question but that low-quality wood predominates in most hardwood stands.

Log grades are an indication of the quality, not only of the standing timber but also of the growth that is occurring. Although much of the hardwood volume in Grade 3 logs is in small trees that would gain in quality if left to grow to larger sizes, some of it is in larger trees too poor to put on quality growth. Thus, from a quality standpoint, whatever growth is added to this share of the volume is largely of poor quality. On the whole, about one-third of the sawtimber growth of eastern hardwoods is believed to be in medium- to high-quality logs, but, in Indiana, Kentucky, and Ohio, studies indicate that the percentage of net sawtimber growth in logs of this quality ranges from 14 to not more than 20 percent. In the Lake States, between 1936 and 1953, the total volume of hardwood sawtimber in Grade 1 logs declined 40 percent. Decreases ranged from 60 to more than 80 percent for such hardwoods as sugar

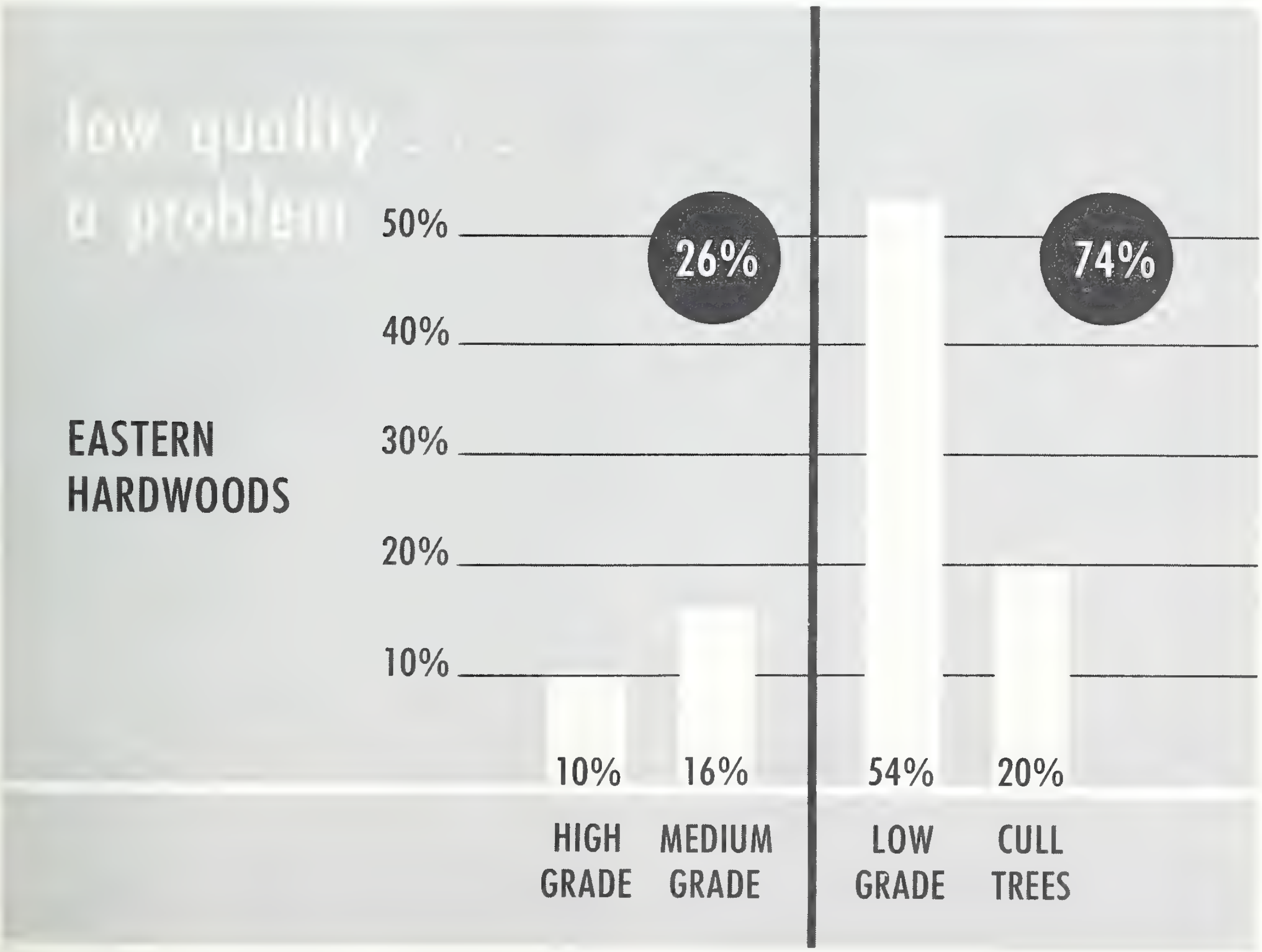

Figure 27

maple, yellow birch, beech, and soft maple, which more than compensated for the increases in other species, notably basswood 6 percent, oak 25 percent, and aspen nearly 200 percent.

Small Trees Lack Quality

For lumber, veneer, and similar end uses, small size is an important limitation. Generally added growth means better quality until overmaturity and decay set in. Small trees have few high-quality logs. As yet, tree size does not appear to be a major factor in the West because of the concentration of volume in old-growth stands. This is apparent from the distribution of sawtimber volume by species and diameter class groupings shown in table 38. In the East, however, two-fifths of the hardwood sawtimber volume and two-thirds of all softwood sawtimber volume is in trees of 15 inches and less, and one-fourth of the softwood volume is in the smallest (10-inch) diameter class. If quality of growth roughly corresponds to quality of standing timber, from 40 to 70 percent of the sawtimber growth of eastern species is on trees too small to yield high-quality logs.

TABLE 38.—*Distribution of sawtimber volume by tree-diameter class, 1953*

WEST

Tree-diameter class (inches)	All western softwoods	Douglas-fir	Ponderosa and Jeffrey pines	Sugar and western white pine
	Percent	*Percent*	*Percent*	*Percent*
12 through 20	23	18	20	21
22 through 30	27	23	36	20
32 and larger	50	59	44	59
All classes	100	100	100	100

EAST

Tree-diameter class (inches)	All eastern species	Softwood	Hardwood
	Percent	*Percent*	*Percent*
10	9	24	--------
12 and 14	42	43	42
16 and 18	27	21	30
20 and larger	22	12	28
All classes	100	100	100

In a few places, information is available from timber inventories about trends in tree size. For example, between 1935 and 1948 softwood trees in Mississippi 20 inches and larger decreased 42 percent in number. In the South Atlantic Region between 1930 and 1953 surveys, the volume of softwood sawtimber trees 20 inches and larger declined 31 percent while the volume of hardwood trees in the same size class increased slightly.

Quality Species Are Diminishing

For most end uses, certain species are considered more desirable than others. Successive surveys show that less desirable species are tending to displace preferred species in both the East and the West. In the South, the longleaf-slash pine type is losing ground to the loblolly-shortleaf pine type, which in turn is being replaced in some places by aggressive hardwood types. The once extensive white pine type of the Lake States has been reduced to about a million acres and has been replaced by an aspen-birch type. Hardwoods tend to supplant softwoods in some spruce-fir and white pine stands in the Northeast. Among the oaks, which comprise three-eighths of eastern hardwood growth, it is estimated that 55 percent of the growth is attributable to the less desirable species. In the West, other conifers are not uncommonly superseding the more valuable white pine, Douglas-fir, and ponderosa pine.

Trend in Wood Properties Indicates Quality Decline

Wood-quality evaluation studies during the last quarter century indicate a decline in intrinsic wood quality. The heavily cut, understocked, second-growth hardwoods of the East yield wood that is generally inferior to old-growth timber. This rapidly grown product is heavier, coarser, stronger, and tougher than the old-growth timber, but is definitely poorer with respect to texture, grain pattern, dimensional stability, machining properties, and other characteristics required for fine furniture, cabinets, interior trim, and similar quality uses. The basic quality of valuable softwoods has likewise declined. The largely understocked pineries of the South, for example, are producing wide-ringed low-density wood that is low in fiber yield, low in mechanical strength, and high in shrinkage along the grain, and that has a marked tendency to warp. A similar situation is developing in second-growth stands of such western softwoods as Douglas-fir and ponderosa pine.

Quality Will Continue To Be Needed

In appraising quality, two opposing trends are evident. One is the apparent decline in quality of raw material, the other is technological progress to overcome this decline. To a considerable degree, these two trends offset each other. There are extremists who believe that quality of the

growing tree is no longer a factor to be considered with respect to timber supplies, and that national needs will be adequately met merely by growing sufficient cellulose irrespective of size, species, condition, or growth rate. Others contend that quality of raw material will be as significant in the future as in the past and appear to overlook technological gains.

Despite the progress in technology, wood of good quality is needed to produce many of the kinds of wood and wood-fiber products that are in demand. Good laminated arches, ship timbers, and other structural members, for example, are not fabricated from wood of nondescript quality. It is incorrect to assume, as some do, that wood quality is unimportant for pulp, paper, or wood-fiber products. Fiber yield, length, and strength, felting properties, and uniformity of raw material are important wood characteristics for such uses.

Despite technological progress, it is likely that quality of standing timber will become more instead of less of a problem during the next several decades. In view of this, and although quality is not as essential as formerly, the safe policy appears to be to continue to grow substantial amounts of high-quality timber. With proper cultural measures, quality timber of required species, size, and grade can be grown in less time than was needed to produce the old-growth forests.

Protection Against Destructive Agents

One of the greatest deterrents to present and future productivity of forest land is the damage caused by fire, insects, disease, weather, animals, and other destructive agents. These affect growth in many ways. They kill trees. They weaken tree vitality and slow up growth. Trees may be deformed or stunted. Seed may be eaten and seedlings eaten, grubbed out, trampled, or broken. Everyone is familiar with the damage that may be wrought by ice, snow, flooding, blowdown, and drought. Understocking may result from these agents, as may site deterioration, poorer timber quality, and encroachment of inferior species.

The estimated total mortality in 1952 from all destructive agents was 12.7 [12] billion board-feet, or an amount equivalent to one-fourth of net sawtimber growth (fig. 28). About 3.1 billion board-feet were salvaged. In addition to this annual mortality loss, there are further losses from growth that greatly exceed mortality. These total losses referred to as "growth impact" were estimated in 1952 at 43.8 billion board-feet, a figure approaching the net sawtimber growth. If such losses could be materially reduced, the added timber available for use would go a long way toward meeting the country's increasing needs. Growth-cut relationships in both sawtimber and growing stock would become more favorable in many localities, and projected demand estimates would appear much easier to attain.

[12] See footnote 2, table 29, p. 48; and footnote 1, table 39, p. 64.

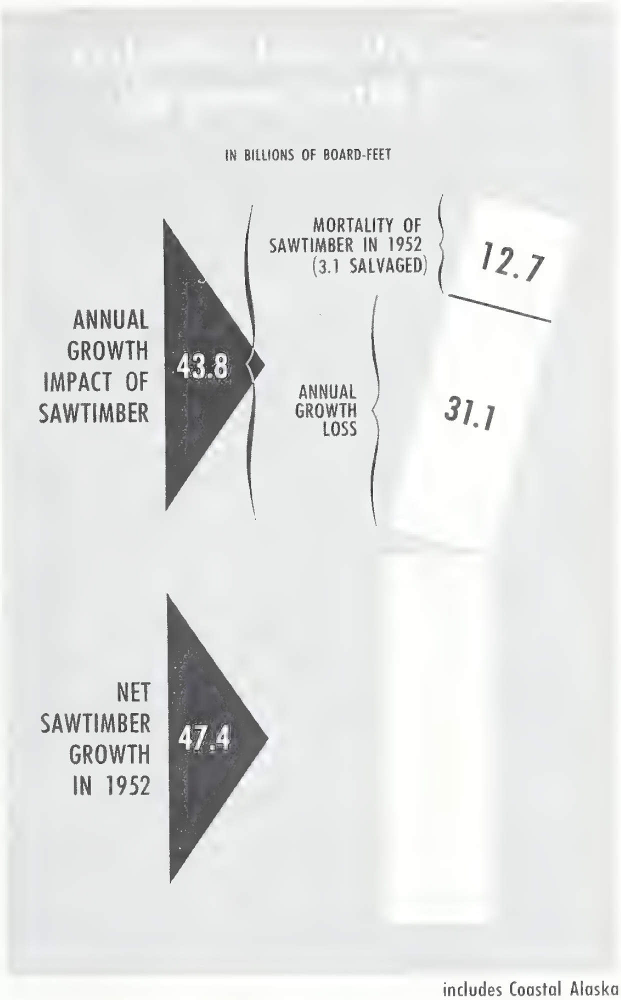

Figure 28

Growth Impact—A Concept for Estimating Total Losses

In attributing losses to various destructive agents, an effort has been made to reflect the full impact of these losses on growth. It has long been recognized that mortality loss occasioned by a destructive agent may be insignificant in terms of measured volume, yet the annual loss of sound standing timber, through reduced growth, may be very large over a period of years. Thus, total or partial destruction of a seedling or sapling stand results in no immediate mortality measurable in terms of board-feet or cubic feet, but in later

years may be the cause of large reductions in growth of sawtimber and growing stock.

In the Timber Resource Review, nationwide estimates have been developed for the first time for both mortality and this additional loss of growth.

A new term used to describe this total damage is "growth impact." It consists of two elements, (1) mortality, which simply means loss of trees of measured size through death from natural causes, and (2) growth loss.

Growth loss consists of (a) reductions in growth due to reduced tree vigor, increase in amount of cull, site deterioration, defoliation, or any other factors reducing growth; (b) losses in growth as a result of delays or deficiencies in stocking resulting from a destructive agent; and (c) losses in growth and prospective yields due to the killing of trees below measured size. Thus growth impact, as used in the Timber Resource Review, consists of mortality in 1952 plus the growth losses in 1952 and subsequent years resulting from 1952 events. Growth impact represents the annual loss in growth to the extent that destructive events of each year are stabilized at the 1952 level of such events. Growth impact, a new term for something that has long been recognized, is discussed more completely in the section "Forest Protection." It is believed to be a more sound and realistic indicator of the true effect of destructive agents than is mortality alone.

Growth impact considers only losses in volume. Additional losses in quality are known to take place, but were not evaluated. Comparisons of mortality and growth impact as subsequently presented show that the latter may exceed mortality three to four times. This means that traditional concepts as to the significance of destructive agents will need to be adjusted upward.

Frequently growth impact on a given stand of timber results from the activity of two or more destructive agents. For example, in eastern hardwoods, heart rot fungi gain access most often through basal fire wounds, but they also attack through logging wounds and broken limbs resulting from wind or ice storms. Lightning-struck trees may be attacked by bark beetles which may spread to nearby trees. Often the last of two destructive events obscures effects of the earlier one. There are many such examples.

The complexity of such interrelations and the current lack of information on the initial cause of damage in many cases precludes the possibility of so assigning loss. Thus, where two or more destructive agents may have been involved, losses have been assigned to the most immediate or direct cause. For example, growth impact due to heart rot in eastern hardwoods has been attributed to disease rather than partly to fire, partly to weather, and partly to logging wounds. Losses resulting from fires that started in the heavy accumulation of fuels resulting from a blowdown have been attributed to fire rather than weather.

Estimates of damage from destructive agents in the Timber Resource Review are not comparable to damage estimates made in the 1945 and earlier appraisals of the timber situation for two reasons:

(1) The Timber Resource Review includes both epidemic and endemic mortality from insects and disease, whereas earlier appraisals included only estimates of epidemic timber mortality not salvaged. As a result, mortality in the Timber Resource Review is more than three times that of earlier estimates.

(2) Estimates of growth impact have been developed. This has not been done before on a national scale. In cubic feet, the growth impact from destructive agents other than fire is more than nine times that of the mortality loss given in the 1945 Reappraisal. Failure to understand these differences might lead to the erroneous conclusion that little progress has been made in controlling many of the more serious insect and disease epidemics. Such a conclusion would not be justified.

In addition to the insect, disease, fire, and other losses that form the basis for the mortality and growth impact estimates in the Timber Resource Review, there are the so-called "catastrophic" losses, which are of extraordinary severity and so unusual as to be unpredictable as to location or frequency. These losses are discussed separately and are one of the major reasons why a margin is included in the estimates of the growth needed to meet projected timber demand.

Destructive Agents Take Extraordinary Toll

As noted earlier, mortality of sawtimber in 1952 as the result of damage by fire, disease, insects, weather, and other factors, was 12.7 billion board-feet. Adding to this a growth loss of 31.1 billion board-feet means that growth impact of 43.8 billion board-feet was nearly four times mortality (table 39). These estimates, however, represent total losses without allowance for the amount of dead timber that was utilized. Salvage amounted to about 770 million cubic feet of growing stock including over 3 billion board-feet of sawtimber. Thus, for sawtimber, there was a net loss due to mortality of 9.6 billion board-feet, and of 40.7 billion board-feet due to growth impact. In terms of growing stock, the net losses were 2.7 billion

cubic feet of mortality and 10.4 billion cubic feet of growth impact.

On a sectional basis, about 70 percent of sawtimber mortality occurred in the West. The remainder was about equally divided between the North and South (table 40). In terms of growth impact, however, the distribution of loss was quite different; loss was almost equally divided among all sections of the country.

By causative agents, disease, insects, and fire were the most important, regardless of whether the comparisons are in terms of sawtimber or growing stock, growth impact or mortality, except that weather in 1952 outranked both disease and fire as a mortality cause with respect to both sawtimber and growing stock (table 39). These relationships are shown graphically for sawtimber in figure 29.

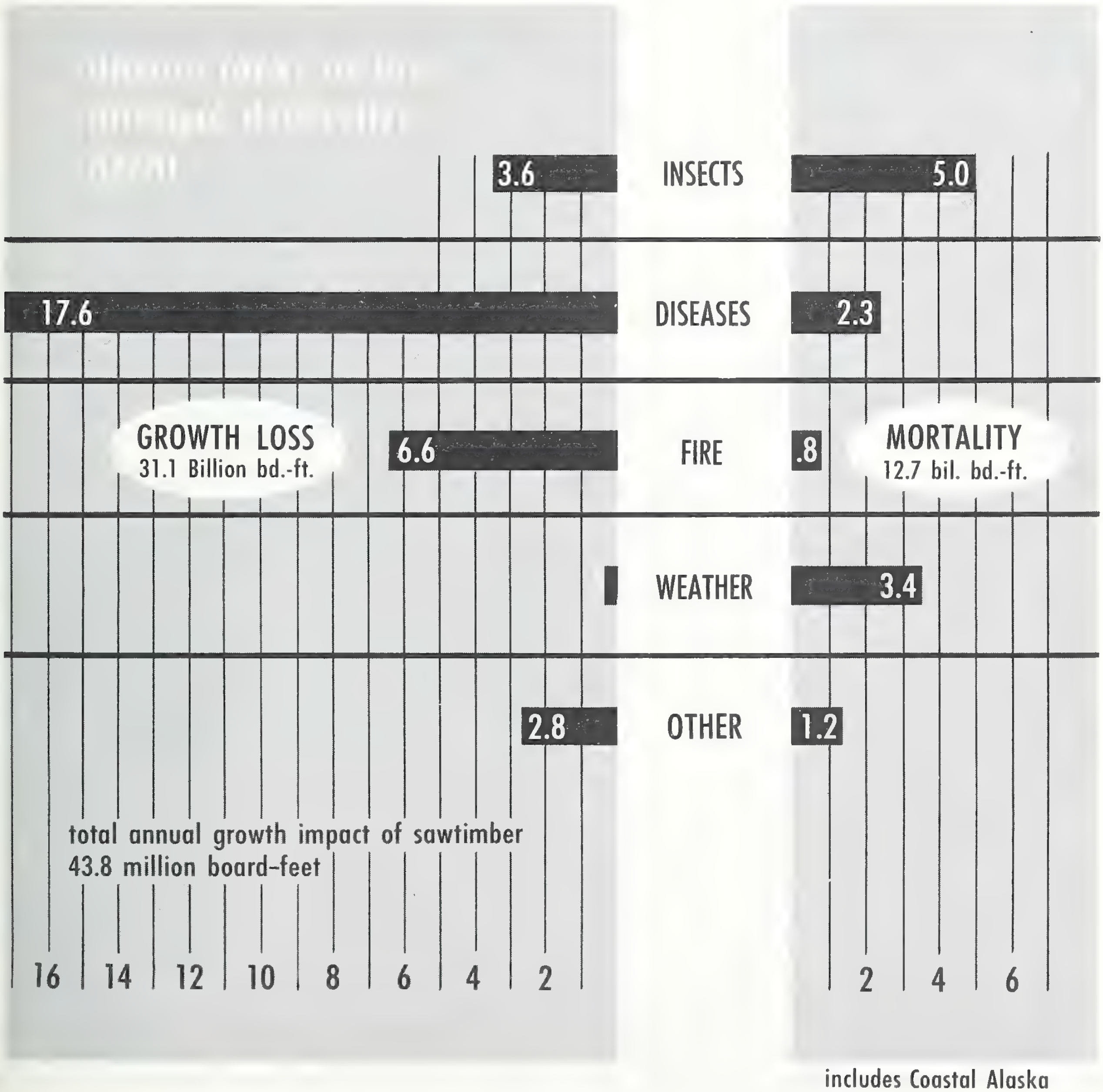

Figure 29

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TABLE 39.—*Mortality and growth impact resulting from 1952 damage, by cause*

GROWING STOCK

Cause	Mortality [1]		Growth impact	
	Million cu. ft.	*Percent*	*Million cu. ft.*	*Percent*
Fire	240	7	1, 690	15
Disease	770	22	5, 050	45
Insects	1, 000	28	1, 780	16
Weather	840	24	950	8
Animals	70	2	1, 010	9
Other	590	17	730	7
Total	3, 510	100	11, 210	100
Salvage	−770	------	−770	------
Net loss	2, 740	------	10, 440	------

LIVE SAWTIMBER

Cause	Mortality [1]		Growth impact	
	Million bd.-ft.	*Percent*	*Million bd.-ft.*	*Percent*
Fire	780	6	7, 370	17
Disease	2, 240	18	19, 890	45
Insects	5, 040	40	8, 620	20
Weather	3, 390	27	3, 870	9
Animals	190	1	2, 720	6
Other	1, 030	8	1, 360	3
Total	12, 670	100	43, 830	100
Salvage	−3, 090	------	−3, 090	------
Net loss	9, 580	------	40, 740	------

[1] Estimates represent actual mortality in 1952. They differ slightly from estimates presented in table 29 which represent the current level of mortality as indicated by trends over a long period of years, as determined in 1952.

Fire ranked lower than either insects or disease as a destructive agent in terms of either mortality or the more inclusive concept of growth impact. In 1952, fire caused about one-fourth as much mortality as did weather. Probably the major reason why damage estimates show other causes to be more serious than fire is because of the tremendous strides made in forest fire prevention and control, and the much more effective action against fire than against other destructive agents. Fire remains an extremely important menace to forest productivity even under present-day intensity of prevention and control effort. If these efforts were relaxed, fire could easily become the number one destroyer of the forest.

Damage ascribed to weather, animals, and a miscellaneous group of other factors is significant and should not be overlooked. Weather damage from wind, ice and snow, lightning, and drought caused greater mortality than disease or fire in 1952, but had far less growth impact. In that year, damage from weather was greater in the

TABLE 40.—*Mortality and growth impact resulting from 1952 damage, by section*

GROWING STOCK

Section	Mortality [1]		Growth impact	
	Million cu. ft.	*Percent*	*Million cu. ft.*	*Percent*
North	1, 150	33	4, 310	38
South	630	18	4, 000	36
West and Coastal Alaska	1, 730	49	2, 900	26
Total	3, 510	100	11, 210	100
Salvage	−770	------	−770	------
Net loss	2, 740	------	10, 440	------

LIVE SAWTIMBER

Section	Mortality [1]		Growth impact	
	Million bd.-ft.	*Percent*	*Million bd.-ft.*	*Percent*
North	2, 080	16	13, 840	32
South	1, 770	14	15, 440	35
West and Coastal Alaska	8, 820	70	14, 550	33
Total	12, 670	100	43, 830	100
Salvage	−3, 090	------	−3, 090	------
Net loss	9, 580	------	40, 740	------

[1] Estimates represent actual mortality in 1952 in contrast to estimates appearing in table 29 which represent the current level of mortality as indicated by trends over a long period of years, as determined in 1952. The estimates are the same in either case, except for the West.

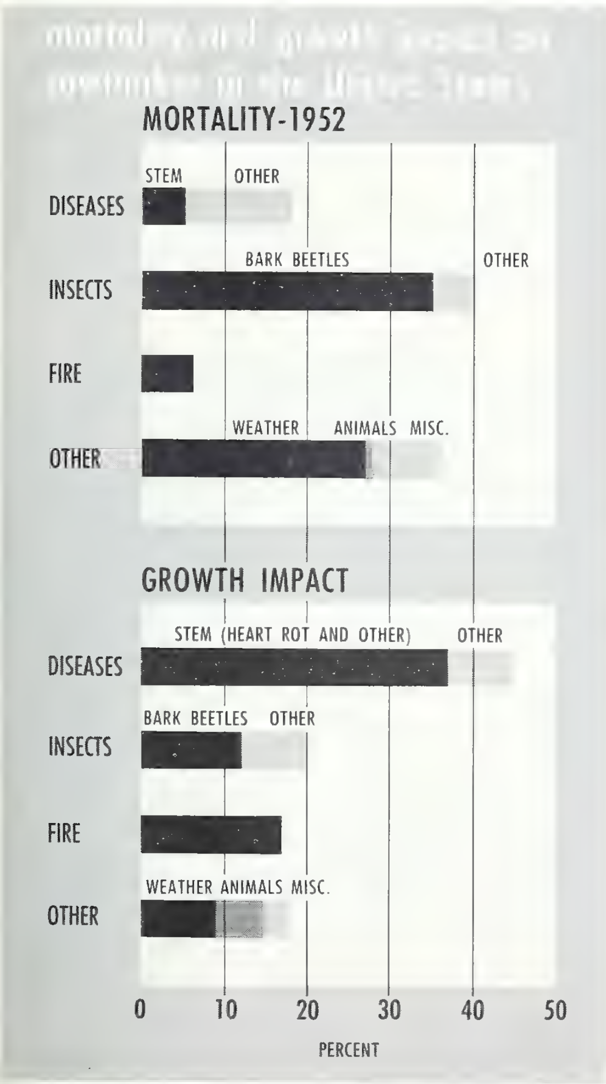
West than in other sections. Damage from a variety of animals, including domestic livestock, big game, porcupines, squirrels, and mice, is more serious in the North and West than in the South. Such damage can be controlled or reduced although measures may prove costly.

Insects Cause the Greatest Mortality

Insects were responsible for 40 percent of all the mortality of sawtimber in 1952, and 28 percent of the mortality of growing stock. In terms of sawtimber, insects outrank disease as a cause of mortality by a ratio of 2 to 1, and fire by a ratio of 7 to 1. In terms oı the more comprehensive effects of growth impact, however, insects were only about half as damaging as disease, and about on a par with fire as a destructive agent.

On a sectional basis, insects were faı more important in the West than in other sections, and of least importance in the North (table 41). Ninety percent of all sawtimber mortality caused by insects was in the West, and about half of all sawtimber mortality in the West from all causes was due to insects.

There are many different kinds of insects. Bark beetles are responsible for 90 percent of insect-caused mortality. In terms of growth impact, bark beetles are somewhat less important, and the defoliators and other insect groups become more so. However, even with respect to growth impact, bark beetles account for three-fifths of the insect damage (table 42 and fig. 30). The "other insects" group includes hardwood borers, white pine weevil, pine tip moth, cone and seed insects, Saratoga spittlebug, and balsam woolly aphid.



includes Coastal Alaska

Figure 30

TABLE 41.—*Timber mortality on commercial forest land, 1952*[1]

GROWING STOCK

Cause	All sections	North	South	West and Coastal Alaska
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Fire	240	40	130	70
Disease	770	460	70	240
Insects	1, 000	70	110	820
Weather	840	210	120	510
Animals	70	40	(2)	30
Other	590	330	200	60
Total	3, 510	1, 150	630	1, 730
Salvage	−770	−150	−240	−380
Net loss	2, 740	1, 000	390	1, 350

LIVE SAWTIMBER

Cause	All sections	North	South	West and Coastal Alaska
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Fire	780	70	300	410
Disease	2, 240	910	230	1, 100
Insects	5, 040	100	410	4, 530
Weather	3, 390	500	400	2, 490
Animals	190	80	(2)	110
Other	1, 030	420	430	180
Total	12, 670	2, 080	1, 770	8, 820
Salvage	−3, 090	−280	−620	−2, 190
Net loss	9, 580	1, 800	1, 150	6, 630

[1] See footnote 1, table 39.
[2] Less than 5.

TABLE 42.—*Sawtimber mortality from insects and disease in 1952 and growth impact of 1952 damage*

INSECTS

Cause	Mortality[1]		Growth impact	
	Million bd.-ft.	*Percent*	*Million bd.-ft.*	*Percent*
Bark beetles	4, 530	90	5, 410	63
Defoliators	30	1	1, 310	15
Other insects	480	9	1, 900	22
All insects	5, 040	100	8, 620	100

DISEASE

Cause	Mortality[1]		Growth impact	
Heart rot and other stem diseases	610	27	16, 180	81
Systemic diseases	360	16	640	3
Root diseases	300	13	600	3
Foliage diseases	40	2	110	1
Other diseases	930	42	2, 360	12
All diseases	2, 240	100	19, 890	100

[1] See footnote 1, table 39

Disease Causes the Greatest Growth Impact

Diseases far outrank all other causative agents in their total adverse effects on forest productivity. Although diseases do not kill as much timber outright as do insects or weather, their total growth impact is far greater. In terms of either sawtimber or growing stock, diseases account for 45 percent of the growth impact caused by all destructive agents (table 39).

Sectionally, disease occasions the greatest growing stock mortality in the North, and the greatest sawtimber mortality in the West. The South ranks relatively low compared to other sections in extent of disease mortality (table 41).

One reason why diseases rank higher than other destructive agents in terms of growth impact and lower than insects in terms of mortality is because many diseases such as the heart rot, leaf diseases, and the killers of seedlings and saplings cause little mortality of growing stock, yet account for a large share of the ultimate effect of disease on production of wood. Most of the forest tree diseases are native, but occasionally these normally endemic diseases become epidemic. Some of the most destructive diseases, for example, the white pine blister rust and the chestnut blight, are not native, but have been introduced from other continents.

Heart rot and other stem diseases cause 27 percent of disease mortality, and over 80 percent of the growth impact due to diseases (table 42). Other important groups in terms of mortality caused by disease are the systemic diseases which include birch dieback, pole blight of western white pine, oak wilt, and sweetgum blight, and the root diseases including Douglas-fir root rot and little-leaf disease of shortleaf pine.

Fire Is Potentially the Greatest Enemy

The effects of fire, as is true with other agents, vary from year to year. Growth impact from fire in 1952 was about 8 percent less than the average for the previous 5-year period. In 1952, fire accounted for 6 percent of the total sawtimber mortality, and 7 percent of the growing stock mortality. In terms of growth impact, fire was relatively more important and accounted for about 15 percent of the total damage caused by all destructive agents.

Moreover, fires often set the stage for subsequent attacks by insects and diseases. They often destroy wildlife and forage for domestic livestock and big game. Likewise, fires occasionally result in loss of human life, and severe fires are often followed by floods and accelerated erosion. Fire can eliminate the forest completely and remove land from timber production for many years.

Mortality from fire was most serious in the West in terms of sawtimber, and in the South in terms of growing stock. Fire causes a larger share of total mortality in the South than in either the North or West (table 41).

Fire was the first of the serious destructive agents which was aggressively attacked through the organized and cooperative efforts of Federal, State, and local governments and owners of private forest land. Great progress has been made as shown by such criteria as the area protected in relation to the total area needing protection, the class of protection applicable to different areas, and the area burned each year.

An estimated 673 million acres in the United States needs protection from fire. This includes nearly all commercial forest land and approximately 185 million acres of noncommercial forest land.[13] Noncommercial forest land needs protection because it is intermingled with or adjacent to commercial timberland or is highly valuable watershed or recreation land. Eighty-eight percent, or 591 million acres, of the total needing protection now receives it in some degree in 1952 [14] (fig. 31). Nearly 100 percent of Federal ownerships receive some degree of protection, 93 percent of other public ownerships, and 81 percent of the private forest land (table 43).

includes Coastal Alaska

Figure 31

[13] A relatively small acreage of 10 million acres of nonforest land in California and North Dakota is included in these estimates and cannot be readily segregated.

[14] The unprotected area which needs protection dropped from 82 million acres in 1952 to 41 million acres in 1957.

TABLE 43.—*Status of protection from fire, 1952*

Ownership	Area requiring protection	Part of area for which protection is adequate in the—		
		Worst years	Average years	Easy years
	Million acres	*Percent*	*Percent*	*Percent*
Private	425	12	59	81
National forest	140	16	89	100
Bureau of Land Management	40	23	87	100
Indian	18	4	44	97
National Park	6	57	99	100
Other Federal	11	3	47	93
Other public	33	35	76	93
All ownerships	673	15	68	88

Though 88 percent of the area needing protection receives adequate protection in easy years, and though 68 percent is protected sufficiently well to meet the fire situation in the average year, only 15 percent is protected adequately to meet the fire situation in worst years and under peak load conditions (fig. 32).

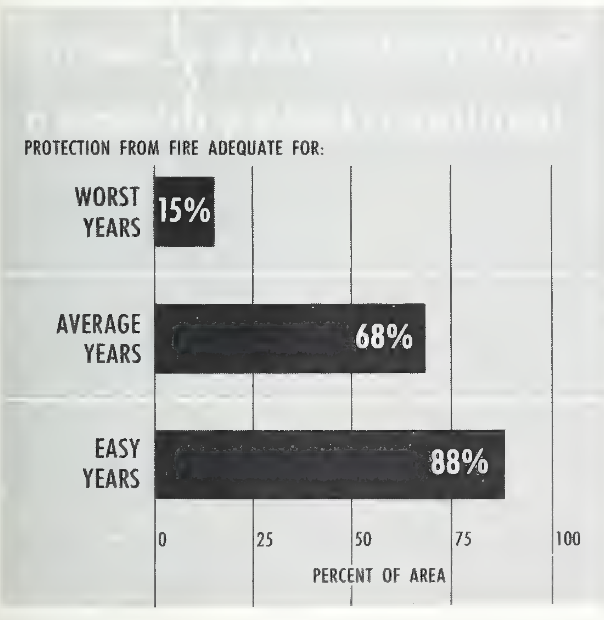


Figure 32

The degree of protection varies considerably by ownership, particularly with respect to protection that is adequate to meet the situation in the worst and average years. Only 12 percent of the private land and 16 percent of the national forests receive a degree of protection sufficient to adequately meet the situation in the worst years (table 43). In contrast, national parks are the best protected with 57 percent adequately protected even in the worst years.

There were 128 thousand forest fires in the United States in 1952, one-third of which were incendiary fires. An additional 61 percent were also man-caused. Six percent of the fires were due to lightning. Of the man-caused fires (excluding incendiary), the chief causes were debris burning (20 percent), smoking (20 percent), camping (4 percent), and railroads and lumbering (5 percent). In comparison to some of the estimates for 1941–45, the percentage of lightning fires doubled and the percentage of railroads and lumbering fires was almost halved, but the other man-caused fires continued to account for close to 90 percent of the total.

The longtime trend in the area burned each year of all forest land needing protection has been steadily downward during the past quarter of a century, for which fairly reliable statistics have been available. For example, the average annual area burned during 1926–30 was 41.6 million acres. This decreased rather steadily with minor fluctuations to the most recent average annual estimate of 11 million acres for 1951–54. This longtime reduction has been due to both the increased efficiency of protection techniques and the addition to the protected area of substantial acreages formerly unprotected.

However, since 1940 the area burned per million acres protected has not declined. This means that recent reductions in total area burned on all land—both protected and unprotected—have been primarily the result of reductions in area burned on land put under protection for the first time. Protection is being extended to the remaining unprotected area at a rate indicating that in the 1960's all area will be protected and the area burned annually may level off to about 8.7 million acres. Until protection is intensified and the efficiency of protection techniques improved, further substantial reductions are not likely.

Reduction in Losses Expected

The expectation of an average annual burned area of 8.7 million acres during the 1960's represents a reduction of 25 percent from the average area burned each year during 1951–54 and 40 percent from the area burned in 1952. This results in an outlook for about a 35-percent reduction in growth impact from fire.

The outlook for reductions in growth impact from other destructive agents is more difficult to appraise. There are no annual statistics collected over a long period of years on the damage done by insects, disease, animals, and weather. Therefore, statistical trends are not available. However,

there are several developments which indicate that reductions can also be expected in the growth impact from destructive agents other than fire. One of these is the action being taken under the Forest Pest Control Act of 1947 to detect and control attacks by insects and disease. New insecticides and improved methods of application are increasing the effectiveness of insect control. Greater accessibility, more efficient equipment, and rising timber values will favor continuation of the current trend toward increasing salvage of dead and dying timber.

Timber owners are gradually becoming aware of the basic principle that many kinds of losses can be reduced by indirect methods such as better forest management practices. Timber stand improvement operations and other management measures that improve the thrift and vigor of forests help to control losses. Forest tree improvement programs aimed at development of resistant strains of trees are increasing and hold promise for the future although they may not add significantly to supply during the century.

Because many forms of insect damage can be reduced by direct attack on the insects, the reduction in growth impact from this cause may reach or closely approach the percentage reduction expected from advances in fire control. However, with diseases, weather, animals, and miscellaneous causes of loss where indirect methods of control must play a larger part, percentage reductions will probably be smaller than those for fire and insects.

Catastrophic Losses Take Additional Toll

In addition to the losses from destructive agents considered in the mortality and growth impact estimate, there are losses from unpredictable events characterized by extraordinary severity and concentrated loss which are termed "catastrophic" timber destruction. Since 1900, 14 such events have been recognized and are enumerated in the section on Forest Protection. Examples include the Tillamook burn of 1933 in Oregon, the New England hurricane of 1938, the more recent destructive outbreak of the Engelmann spruce beetle in Colorado, and the chestnut blight in the East. Total estimated losses from these 14 events exceed 122 billion board-feet, of which approximately 16 billion have been salvaged. Insects were responsible for 52 billion board-feet, fire 32 billion, wind over 19 billion, and disease 18 billion. These total losses prorated over the first half of the century average 2.3 billion board-feet a year, but they are unpredictable as to locality or time. However, 72 percent of the loss occurred in the West. An effort is made to account for such catastrophic losses by providing a margin when estimating needed growth.

Forest Tree Planting

Because so much of the commercial forest land of the United States (114 million acres) is poorly stocked, or nonstocked, and because planting offers an effective way to restore some nonstocked lands to productivity, to improve stocking of some poorly stocked land, and to shorten the lapse of time waiting for natural regeneration, an appraisal of the status of forest planting and planting possibilities was made in connection with the Timber Resource Review.

The planting estimates summarized hereafter are conservative because they do not include (1) planting in lieu of natural regeneration after cutting, (2) interplanting to improve stocking on medium-stocked and some poorly stocked lands, or (3) conversion of agricultural land to forest by tree planting under the Soil Bank program of 1956.[15] It is believed that planting for these purposes will become more common as the intensity of forestry increases in the United States. Therefore, total planting possibilities and needs may ultimately be significantly larger than the estimates in the current appraisal.

Estimates of plantable area and acceptable plantations have been developed. Briefly, plantable area includes lands (1) on which the planting of forest trees is practical from a physical or biological standpoint and gives reasonable promise of economic feasibility, and (2) which need to be planted if they are to be restored to productivity within a reasonable time.

Acceptable plantations are defined as those which have, at the end of the fifth year after planting, at least 400 trees per acre for all eastern species, 200 trees per acre for all western species except Engelmann spruce and lodgepole pine for which the standard is 300. These standards ordinarily wlll provide satisfactory stocking at maturity.

The significance of planting possibilities is emphasized by the estimate that the plantable acreage which was included could be expected to yield an annual growth of 8 billion board-feet after the trees reach merchantable sawtimber size. If this were achieved, the output from the plantable area would equal 17 percent of 1952 net growth of sawtimber. Such an addition to net growth would help substantially in raising growth to the levels needed to meet projected timber demand.

[15] Under the Conservation Reserve part of the Soil Bank program, it is estimated that possibly 5 million acres of farmland may be planted to trees. The land to be planted is from land regularly used in the production of crops (including crops such as tame hay, alfalfa, and clovers, which do not require annual tillage). The Soil Bank program was authorized by the Agricultural Act of 1956, several years after completion of the Timber Resource Review estimates.

Fifty-Two Million Acres Need Planting

About 52 million acres of commercial forest land is classed as plantable area. This is roughly equivalent to 10 percent of all commercial forest land, or 45 percent of the 114 million acres of poorly stocked (73 million acres) or nonstocked (41 million acres) commercial forest land. About 83 percent of total plantable area is in the East and is divided almost equally between the North and South. The remainder or 17 percent is in the West (table 44).

TABLE 44.—*Status of planting on commercial forest land, by section, 1952*

Section	Plantable area	Total area planted to date	Total area of acceptable plantations to date	Planting success [1]
	Million acres	*Million acres*	*Million acres*	*Percent*
North	21.4	3.8	2.7	71
South	21.9	2.3	2.0	85
West	8.6	.8	.5	75
United States	51.9	6.9	5.2	76

[1] Area of acceptable plantations as a percentage of area planted.

About 84 percent of total plantable area is in private ownership, 11 percent in Federal ownership, and 5 percent in other public ownership (table 45).

In addition to the 52 million acres of plantable area on commercial forest land, there are an estimated 5.4 million acres of noncommercial forest land which need planting. Most of this is in the West, about equally divided between public and private ownerships. About one-fifth of this area has primary value for watershed protection and the purpose of planting the remainder would be mainly for improvement of wildlife habitat.

Ninety Percent of the Planting Job Lies Ahead

The total area of acceptable forest plantations in the continental United States is 5.2 million acres. This is equivalent to 10 percent of the remaining plantable area of 52 million acres and about 1 percent of the total commercial forest land area. About ninety percent of the job is still ahead. About half of the acceptable plantations are in the North, 40 percent in the South, and 10 percent in the West.

TABLE 45.—*Status of planting on commercial forest land, by ownership class, 1952*

Ownership	Plantable area	Total area planted to date	Total area of acceptable plantations to date	Planting success [1]
	Million acres	*Million acres*	*Million acres*	*Percent*
Private	43.7	3.4	2.5	74
Public:				
National forest	4.6	1.9	1.4	76
Other Federal	1.0	.2	.2	78
State and local	2.6	1.4	1.1	81
Total	8.2	3.5	2.7	78
All ownerships	51.9	6.9	5.2	76

[1] Area of acceptable plantations as a percentage of area planted.

On an ownership basis, 48 percent of the acreage of acceptable plantations are privately owned, 30 percent are federally owned, and 22 percent are in State, county, and municipal ownership (table 45).

Acceptable plantations have been related to total area planted in order to get some measure of planting success. On a national basis, about three-fourths of total area planted qualifies as acceptable plantations. This varies by sections of the country and by major ownership groups. The most successful planting has been in the South where 85 percent success has been achieved. State and local public ownerships show a slightly greater planting success percentagewise than either Federal or private plantings.

Planting Trend Is Upward

Although most of the planting job lies ahead, the increase in the annual rate of planting is distinctly encouraging. The rate has increased between 5 and 6 times in the past quarter of a century (fig. 33). For example, an average of 68 thousand acres of acceptable plantations were established annually in 1926–29 in contrast to the annual rate of 388 thousand acres in 1950–52. Since then the rate has accelerated rapidly.[16] Planting rates during the next 25 to 30 years are expected to average more than twice the 1950–52 rate, so that by 1985 possibly another 25 million acres will have been transferred to acceptable plantations. There

[16] For 1953–56, the average area planted annually is 769 thousand acres. It is estimated that this acreage planted will result in an average annual establishment of acceptable plantations of 615 thousand acres.

are many reasons for this expected increase, including better machines for planting, increased interest in planting especially by industrial groups, and better nursery stock. To meet these expected increased planting rates, and also to allow for higher planting standards in the future, planting in lieu of natural regeneration, interplanting on areas 10-percent or better stocked, and Soil Bank planting, will require an average annual output of nursery stock of at least one billion trees. This would be more than double the 1952 production of 462 million.

Despite increases in the planting rate during the past 25 years and expected additional increases in the future, it is important to recall that only 400 thousand acres of acceptable plantations resulted from the 1952 planting effort in contrast to the 52 million acres that still needed planting at the end of the year. This was less than 1 percent of the total need (fig. 34). Even with this rate doubled as is expected, it would take many years to cover the plantable area, and would mean substantial areas of land lying idle for a long time.

In summary, the planting situation boils down to: (1) About 52 million acres need planting; (2) acceptable plantations total about 5 million acres or one-tenth of the area in need of planting. This means that 90 percent of the job lies ahead. (3) Although planting trends are distinctly upward, it will take many years to get caught up; and (4) completion of the job holds promise of adding substantially to future growth.

Productivity of Recently Cut Lands

The condition in which the forest is left after cutting greatly influences subsequent growth. From 2 to 4 percent of the commercial forest land has been cut over annually in recent years. Except for the cut that comes from the 50 million acres of old growth in the West and Coastal Alaska, current output of forest products comes from previously cutover lands. All of the eastern commercial forests have been cut over at one time or another with the exception of a few remnants. It follows, therefore, that condition of the land and residual timber stand resulting from cutting is an important factor affecting both current and future growth.

The greatest utility of a survey of forest productivity on recently cut lands is the identification of areas by size and kind of ownership, locality, and forest type that are strong or weak from the standpoint of growth prospects. The survey identifies those areas that meet certain standards of productivity, and areas that are better or poorer than those standards, and it indicates wherein lie the possibilities for greatest improvement in future growth.

Productivity of recently cut forest lands as determined in the Timber Resource Review is based upon a detailed field sampling survey of recently cut lands in all kinds of ownerships in all parts of the country. The field survey was a highly technical and complex job. It is described in detail in the section on Productivity of Recently Cut Lands and in those parts of the appendix which discuss adequacy of data and the criteria for rating productivity.

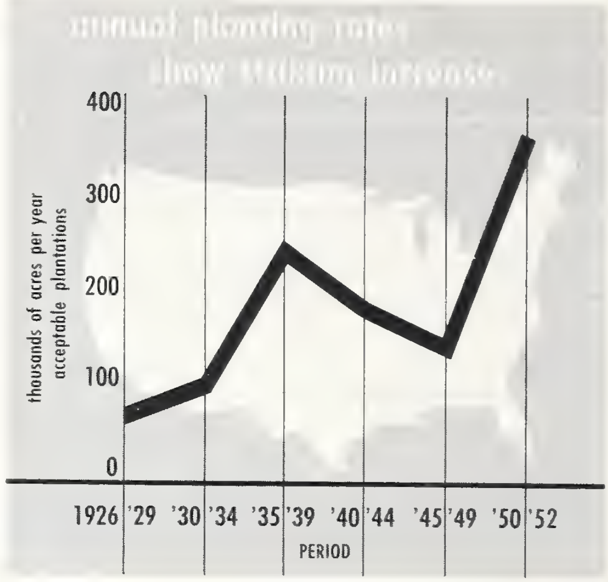


Figure 33

State and privately employed foresters contributed a great deal not only in execution of the survey itself but also in developing the individual productivity criteria for various forest types and localities. Over 40 percent of all cooperative assistance received in connection with the Timber Resource Review, or the equivalent of more than $215,000, was made available for the productivity survey. Field examiners were denied access to only six ownerships, aggregating 1.5 million acres.

This is the second nationwide survey of this general character—the first being undertaken in 1945 by the Forest Service. There have been six other more localized surveys of this general character sponsored by industry, State, or Federal groups, all of which have differed in scope and design.

Results of this productivity survey of recently cut lands cannot be compared with the results of the cutting practices study of the 1945 Reappraisal. At the outset, there was a choice of doing the survey exactly the same way as in 1945 in order to get the best possible trend indications, or of making changes to take advantage of more recent experience and advances in technical knowledge. The latter choice was followed, recognizing at the time that it would sacrifice comparability and the possibility of identifying trends. Probably the best comparison that might be made is

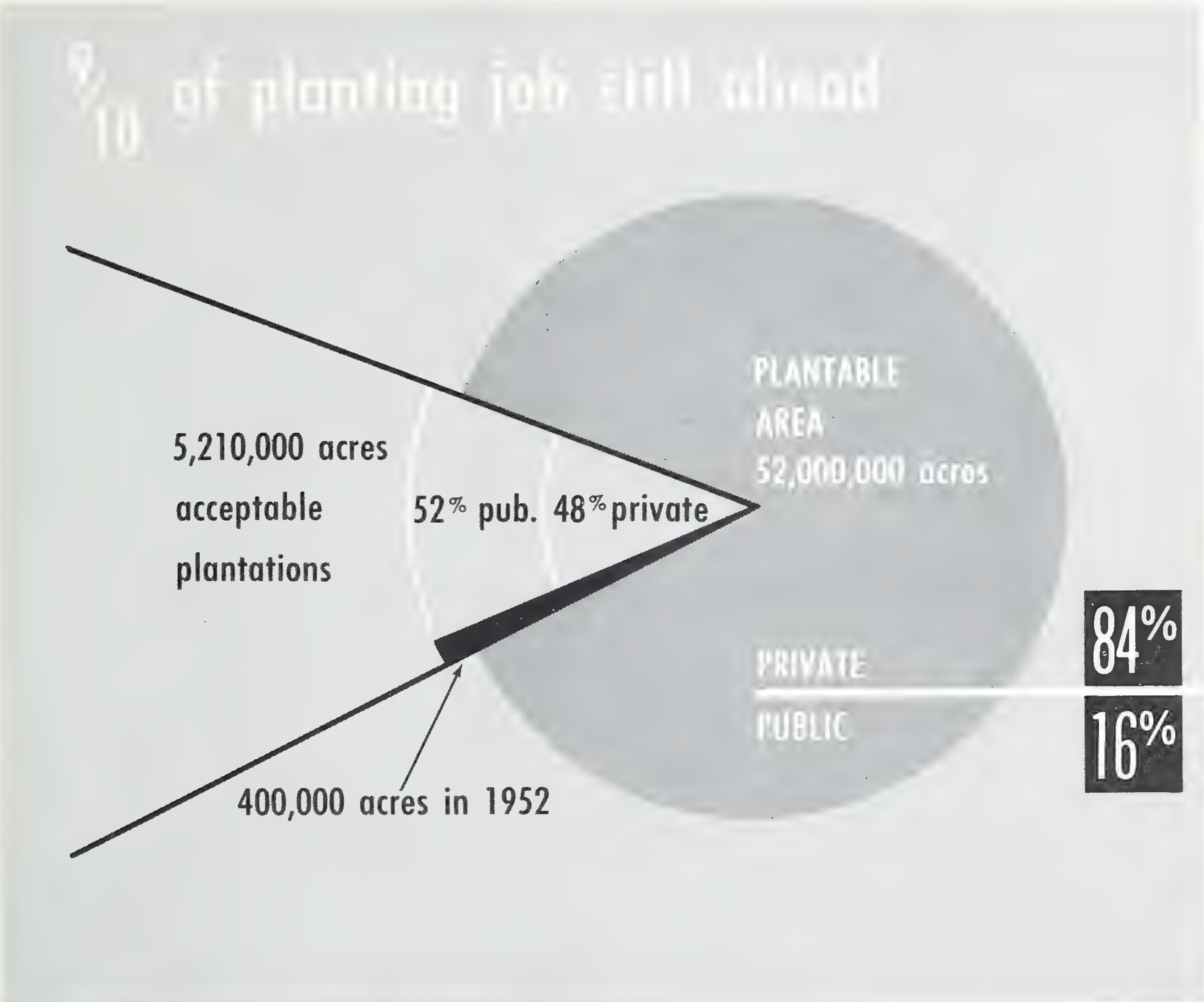


Figure 34

to relate the proportion of recently cut lands in the upper productivity class of the current survey with the combined proportions of "high order," "good," and possibly half of the "fair" practice levels of cutting in the Reappraisal. The Forest Service has made a careful study of possible comparisons but has drawn none, because it believes that any comparisons that might be made would be highly questionable for many reasons.

Productivity Index—A New Concept in Appraising Forest Condition

Essential to an understanding of results of the survey of recently cut lands is a clear grasp of the "productivity index" which was used to classify recently cut lands into various groups. A rating system with indexes ranging from 1 to 100 was developed. This was based on consideration of several individual elements. An index rating of 100 for a recently cut area did not mean it was the best attainable. On the contrary, it only meant that forest condition, i. e., productivity of recently cut lands, was at a standard or level considered reasonably attainable for the particular locality, site, and forest type under current and average operating situations. This is very important and is one of the main reasons why such a large area of recently cut lands qualified for the upper level of productivity. An index of 100 is a higher standard than what might have been adopted as reasonable or practical several years ago; it is a lower standard than what might be reasonable or practical at some future time. The standards are not related to the maximum growth possible nor were they geared to the growth that would result from the most intensive forestry

practices known today. Standards geared to either of these alternatives would have been much higher.

Unlike the 1945 survey, this survey was not concerned with forest management practices. Intent of ownership was considered only in a minor way. Existence of sustained-yield policies, or management plans, and planned use of silvicultural systems were not considered. Conditions on the ground were appraised as they were found regardless of whether they resulted from accident, a bountiful nature, or purposeful action of the owner. The survey covered practically all large-size private and public ownerships, and sampled the medium and small private ownerships. The object was to obtain reasonably reliable data on a regional basis. The term "recently cut lands" relates to the fact that only cuttings made since 1947 were examined and, in the case of two or more cuttings within that period, the most recent cutting was used in most instances.

Four Main Elements of Productivity

The productivity index was designed to reflect the combined effect of four of the most important elements or factors that affect growth following cutting. These are (1) existing stocking, (2) prospects for stocking where present stocking is deficient, (3) species composition, and (4) felling age or the age of trees or stands at the time the cutting occurred. In the field examination, each of these elements was expressed on a rating scale of 0 to 100 with the latter figure representing a standard of current attainability. The individual ratings were combined into a single overall productivity index.

The standard for existing stocking referred to the number of trees or seedlings per acre for a particular site or forest type which met necessary specifications. Any recently cut area with actual stocking of 35 to 50 percent of the "normal" yield table stocking for uncut sawtimber stands would result in an upper level rating for stocking. Standards for trees under sawtimber size represent much smaller percentages of the better stocking found in nature because of the natural tendency of young stands to improve in stocking as they mature.

Standards for prospective stocking recognized the probability of stocking by both natural methods and by planting and were considered only if stocking at the time of examination was deficient. In prospective stocking, such factors were considered as seed sources, seedbed condition, the presence or absence of inhibiting vegetation, topography, and planting plans.

Species composition referred to the kind of trees in the stand and included only commercial species. Species were divided into two groups, (a) desirable, and (b) acceptable. If half or more of the stand were in the desirable class, composition was considered up to standard. If none of the trees were in the desirable class, composition was considered half of standard. This recognized that acceptable species have some value.

The standard for felling age was the age at which the timber stand involved would reach its maximum mean annual growth. If cut prior to that age, deductions from standard were made because the full growth potential of the stand was not realized. The felling age factor was applied only to clear cutting and under rather restricted conditions as explained in the section on Productivity of Recently Cut Lands.

The information on the various elements was obtained for each forest type that had been cut wholly or in part since 1947 on each ownership examined. Each such recently cut forest type per individual ownership was termed an "operating area." The criteria and the standards for the various elements were worked out regionally for each forest type and important locality or site. These are summarized in the appendix. The various elements were combined for each operating area into a productivity index by adding the ratings for existing and prospective stocking (but not to exceed an index of 100), multiplying their result by the composition factor, and then multiplying by the felling age factor (if applicable).

The productivity index scale of 0 to 100 was divided into three broad classes with adjective descriptions of each class as follows: 0–39, lower; 40–69, medium; 70–100, upper. Each individual operating area was assigned to one of three broad classes, depending on the index rating for that particular area. It was then possible to show the proportion of total operating area by size or kind of ownership, or other grouping in each of the three broad productivity classes. This is the manner in which most of the results are presented in the subsequent description and tables. Thus, a statement that 65 percent of the operating area in the country was in the upper productivity class means that 65 percent (areawise) of the forest types on which there was recent cutting in the individual ownerships examined had a productivity index rating between 70 and 100 percent of what is considered reasonably attainable under current conditions. In other words, results are expressed, not in terms of productivity indexes themselves, but in terms of proportion of operating area in the various broad productivity classes.

The Standards Could Be Higher

Much judgment necessarily enters into a procedure such as just described. There is judgment in the choice of the various elements of produc-

tivity, judgment in the development of the detailed criteria for particular localities for each element, and judgment in the system of compilation adopted. There may be some who will feel the standards were set too high. Others may feel that the standards were too low. The Forest Service believes the standards used were reasonable when it is borne in mind that the objective was to relate productivity of cutover areas to a standard of what is currently attainable on the average under practical management, and that a 100-percent rating would mean only that forest conditions met or exceeded that standard.

There are numerous ways in which the productivity standards could be raised or lowered. For example, standards would be raised:

(1) If standards were geared to medium projected timber demand or highly intensive forest practices.

(2) If a felling age higher than that of maximum mean annual growth were adopted in order to recognize the need for growing quality wood.

(3) If a felling age were recognized only for sawtimber rather than for either growing stock or sawtimber depending on whether the cutting was for small or large products.

(4) If standards of composition had been higher.

(5) If higher standards of both existing and prospective stocking had been adopted. The stocking standards were frequently exceeded on properties under management.

On the other hand, productivity standards could be lowered by adjustments in the opposite direction. In view of the magnitude of the estimates of projected timber demand, there would be little justification for lowered standards.

The productivity ratings could have been grouped into more than three broad classes. Under the system adopted, operating areas with an index of 70 are grouped in the same class as those with an index of 95, and those with an index of 10 are grouped with those with an index of 30. More class groupings would have resulted in greater selectivity. For example, if the limits of the upper class had been 80 to 100 rather than 70 to 100, the proportion of recently cut lands in that class would have been 48 instead of 65 percent.

Productivity Varies by Ownership, Location, Forest Type, and Kind of Cutting

In summarizing such a complex survey, the mass of available statistics can readily obscure the main conclusions. For example, nearly 26 thousand individual ownerships were examined and each operating area of this group involved the individual examination of 4 to 30 plots, or 10 to 60 examination points. Furthermore, productivity as evaluated in this survey varies according to such factors as size of ownership, kind of ownership, forest, region or section, and forest type. To be of value, it is necessary to examine the relationship of cutover forest condition to each of these various factors individually and in combination.

Results are expressed in terms of the proportion of operating area in each of three broad productivity classes. Because the operating area of the entire country totaled 235 million acres at the time of this survey, or nearly one-half of the commercial forest land area of the United States, the grouping of operating areas into productivity classes is considered representative of the ownership, section, or forest type in which the operating area occurred.

The overall results of the survey show that 65 percent of the operating area of 235 million acres qualified for the upper productivity class, 24 percent for the medium class, and 11 percent in the lower class (table 46 and fig. 35).

By major ownership groups, it is apparent that public and forest industry ownerships have about the same proportion of their operating areas in the upper class with 80 and 77 percent, respectively. On the other hand, farm and "other" private ownerships, with about the same operating area as public ownerships, but much larger commercial forest land area, have 46 percent in the upper productivity class. Over 50 percent of the farm and "other" private operating area is in the lower or medium classes (fig. 36).

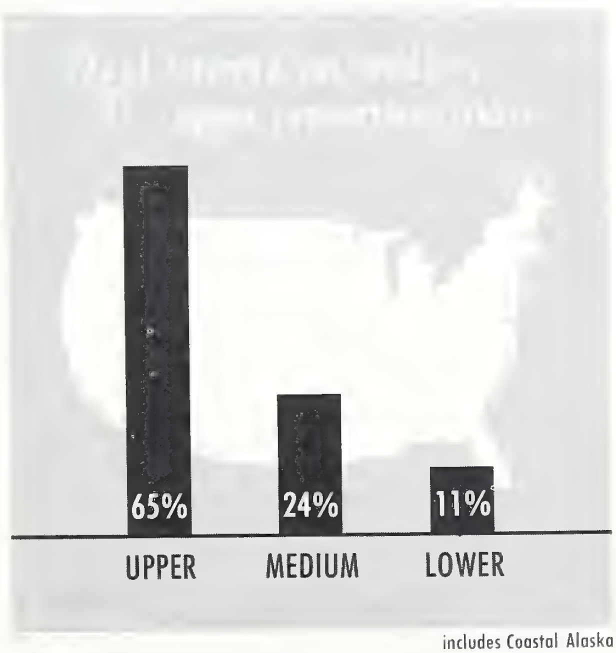
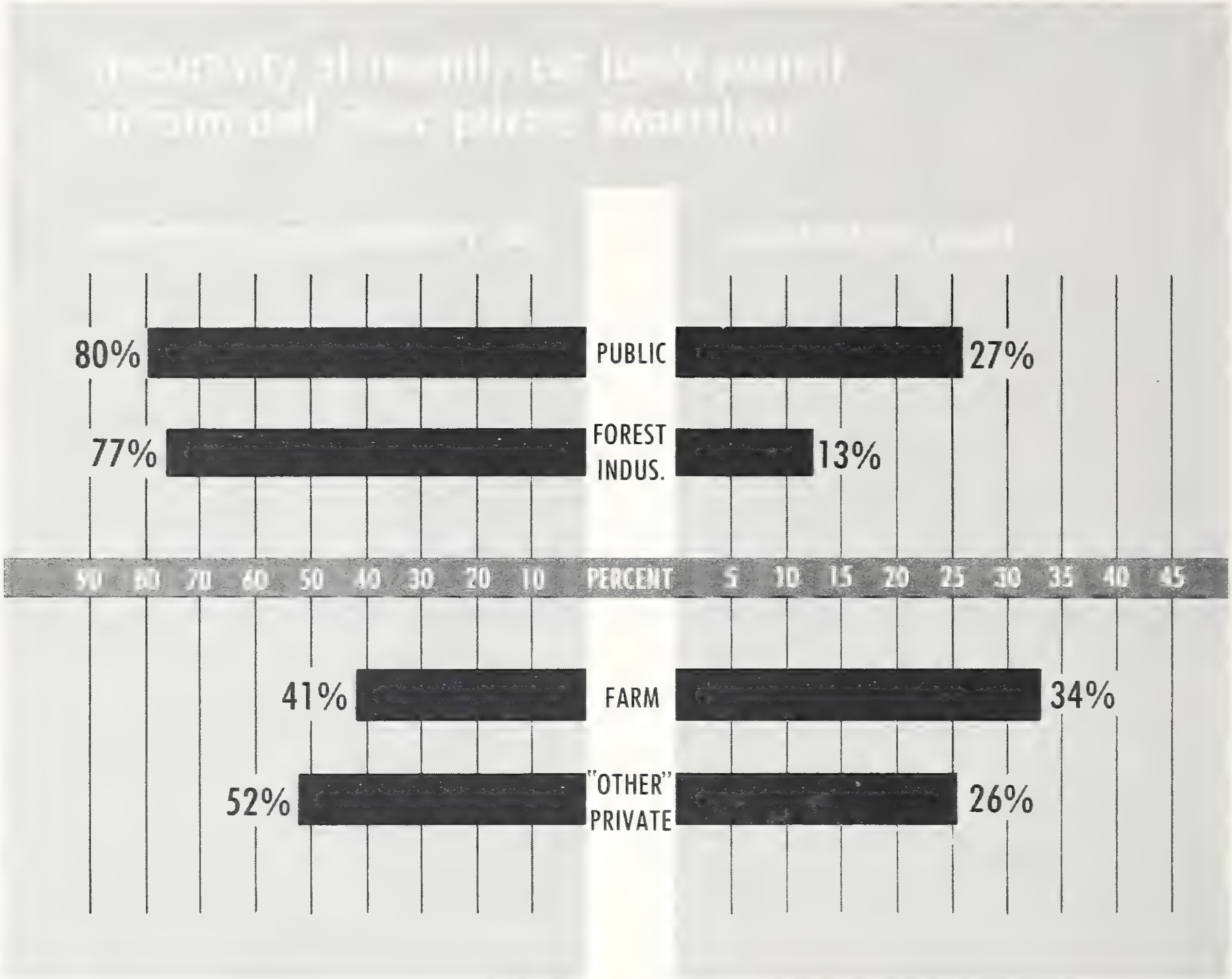


Figure 35



includes Coastal Alaska

Figure 36

TABLE 46.—*Productivity of recently cut commercial forest land in the United States and Coastal Alaska, 1953*

Type of ownership	Commercial forest land	Operating area	Proportion of operating area by productivity class: Upper	Medium	Lower
	Million acres	*Million acres*	*Percent*	*Percent*	*Percent*
Forest industries	62	[1] 44	77	19	4
Farm	165	53	41	37	22
Other private	131	42	52	28	20
Public	131	96	80	17	3
All ownerships	489	235	65	24	11

[1] Excludes an unknown acreage of operating area on the 1.5 million acres of commercial forest land to which access was denied.

Farm and "Other" Private Ownerships in Poorest Condition

To the extent that the productivity indexes truly reflect condition of recently cut lands there is conclusive evidence that the farm and "other" private (meaning private ownerships which are not farm and not forest industry) ownerships are most in need of improvement. For the country as a whole, 41 percent of the operating area in farm ownerships qualified for the upper class, and for the "other" private ownerships, 52 percent so qualified (table 47). Farm ownership has a larger proportion of operating area of medium productivity than does "other" private ownership, and both groups have about one-fifth of their operating area in the lower class. When one recalls that a productivity index of 100 refers only to a standard that is reasonably attainable under average current conditions, it is not reassuring that the productivity index for more than half of the farm

and "other" private ownerships—which make up 60 percent of all commercial forest land—was less that 70 percent of what is reasonably attainable.

Forest Industry and Public Ownerships in Much Better Condition

Forest industry averaged 77 percent of its operating area in the upper productivity class, and public ownerships averaged 80 percent in that class (table 47). Condition of pulp industry lands with 84 percent in the upper class appeared significantly better than the lumber industry with 73 percent in that class. The lumber industry had 6 percent of its operating area in the lower class as against only 1 percent for the pulp industry. The results for the pulp industry were more favorable than for any other major ownership group, with the single exception of the municipal and local public ownerships, which are small in area. All of the various public ownership groups have a large proportion of their operating areas in the upper productivity class.

Small Private Ownerships in Poorer Condition Than Medium and Large Holdings

Regardless of the kind of private ownership, there appears to be a distinct difference in productivity of recently cut areas, depending on whether the ownership is small (under 5,000 acres) or larger than 5,000 acres. There is also a difference between the medium ownerships (5,000–50,000 acres) and the large ownerships (over 50,000 acres), although these differences are not so pronounced (table 48).

For the large private ownerships of all types, nearly 80 percent of the recently cut lands qualify in the upper productivity class; this percent drops to 64 for the medium ownerships and to 40 for ownerships of less than 5,000 acres (fig. 37). The few large farm ownerships average about the same as the large forest industry ownerships, and the "other" private ownerships of large size also rank fairly well. In contrast, small forest industry ownership qualifies 48 percent in the upper class, and small farm and "other" private ownerships 40 and 41 percent.

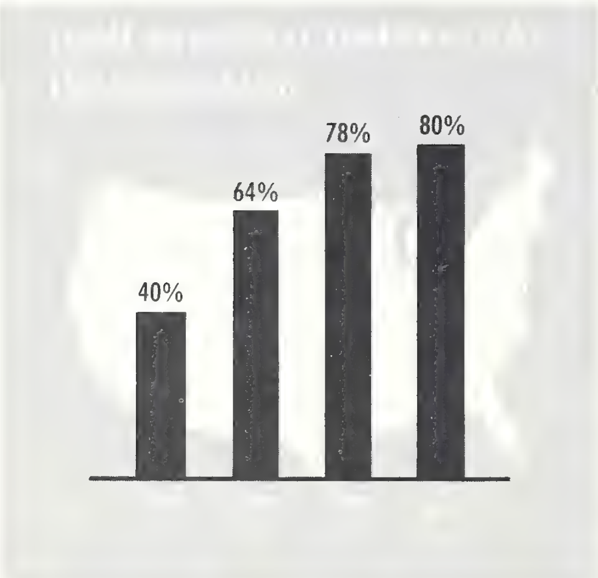
TABLE 47.—*Productivity*[1] *of recently cut commercial forest land, by type of ownership and section, 1953*

Ownership	All sections			North			South			West and Coastal Alaska		
	Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Private:												
Farm	41	37	22	52	35	13	34	38	28	46	42	12
Forest industry:												
Lumber manufacturing	73	21	6	68	24	8	69	23	8	78	19	3
Pulp manufacturing	84	15	1	66	33	1	96	4	[2]	94	1	5
Other wood manufacturing	73	23	4	53	38	9	78	22	[2]	73	9	18
All forest industry	77	19	4	66	31	3	81	15	4	80	16	4
Other private	52	28	20	59	27	14	44	30	26	62	27	11
All private	56	29	15	58	31	11	51	29	20	68	25	7
Public:												
National forest	81	16	3	84	16	[2]	89	10	1	79	17	4
Bureau of Land Management	80	15	5	------	100	------	100	------	------	83	12	5
Indian	74	25	1	94	4	2	100	------	------	70	29	1
Other Federal	80	16	4	56	31	13	83	14	3	85	15	------
State	77	18	5									
County	76	24	------	83	16	1	70	23	7	58	28	14
Municipal and local	93	6	1									
All public	80	17	3	83	16	1	86	12	2	78	18	4
All ownerships	65	24	11	67	26	7	55	27	18	75	20	5

[1] Expressed in percent of operating area in each productivity class. [2] Less than 0.5.

TABLE 48.—*Proportion of recently cut private commercial forest land in the upper productivity class, 1953*

Type of ownership	Size of ownership (acres)						
	All sizes	Large, 50,000 and more	Medium, 5,000 to 50,000	Small			
				Total: Less than 5,000	500 to 5,000	100 to 500	Less than 100
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Farm	41	84	55	40	42	41	37
Forest industry:							
Lumber manufacturer	73	78	74	48	58	30	47
Pulp manufacturer	84	84	79	22	22	------	------
Other wood manufacturer	73	74	73	62	91	5	------
All forest industry	77	81	74	48	58	29	47
Other private	52	69	56	41	42	40	41
All private ownerships	56	78	64	40	44	40	38



includes Coastal Alaska

Figure 37.—Percent of recently cut lands on which productivity is as high as might reasonably be expected today.

The small ownership group is divided into still smaller size classes in table 48. It is difficult to draw any definite pattern other than the general inference that ownerships of less than 100 acres are in somewhat poorer condition than those from 500 to 5,000 acres. Thirty-eight percent of ownerships of less than 100 acres qualified for the upper productivity class, yet they comprise one-fourth of all commercial forest land. These very small ownerships are mainly in farms. Because of the large number of parcels involved, their importance from an acreage standpoint, and their relatively poor forest condition, these forest properties of less than 100 acres constitute an important part of the forest problem of the Nation.

Productivity of Recently Cut Land Best in West, Poorest in South

In the West, three-fourths of the recently cut lands qualified for the upper productivity class in contrast to two-thirds in the North, and slightly more than half in the South. The South had the largest percentage of recently cut lands in the lower productivity class—18 percent in contrast to 5 percent for the West and 7 percent for the North (table 49). The variation in condition of recently cut lands in different sections of the country is explained in large measure by the differing patterns of ownership. The West, where recently cut lands rate higher in productivity than other sections, is dominated by public and the larger private ownerships, whereas the South, with considerably lower productivity on the recently cut lands, is dominated mainly by farm and "other" private ownership.

TABLE 49.—*Productivity by sections*

Section	Commercial forest land	Operating area	Productivity class		
			Upper	Medium	Lower
	Million acres	*Million acres*	*Percent*	*Percent*	*Percent*
North	174	64	67	26	7
South	194	88	55	27	18
West and Coastal Alaska	121	83	75	20	5
All sections	489	235	65	24	11

There are certain sectional variations within the same ownership group which are worth noting (table 47). For example, recently cut national-forest lands in the South and the North have a higher proportion in the upper productivity class than do western national forests. On the other hand, State, county, and municipal lands show a considerably higher proportion of operating area in the upper class if they are located in the North. In contrast to these two public ownership groups which show better forest condition in the North or South than in the West, the lumber industry shows just the reverse with 78 percent of its recently cut lands in the West qualifying for the upper class as against 68 and 69 percent for the North and the South. The pulp industry shows still a different pattern with 94 percent or more of its recently cut lands qualifying for the upper class in the South and the West, and 66 percent in the North.

The farm and "other" private ownerships, which are in poorest condition for the country as a whole and are so important from an area standpoint, show considerable variation between different sections of the country. Farm ownerships in the South have the lowest rating with one-third of the recently cut lands in the upper class and 28 percent in the lower class. In the North, over half of the farm-owned lands qualify for the upper class. The "other" private ownership likewise shows the poorest ratings for the South with 44 percent in the upper class.

Productivity Varies by Forest Type

Forest type is another of the variables affecting condition of recently cut lands.

In the East, for all ownerships combined, the aspen-birch and maple-beech-birch types show the highest proportion of recently cut lands in the upper productivity class. The oak-gum-cypress and elm-ash-cottonwood types, on the other hand, show the smallest proportion in the upper class. It does not follow, however, that the forest types which show relatively small amounts in the upper class necessarily show the largest proportion in the lower class. Those types that have the biggest proportions in the lower productivity classes in the East (and they all average about 20 percent) are longleaf-slash pine, loblolly-shortleaf pine, and oak-pine (table 50).

In the West, particularly in the Northern Rocky Mountain Region, the western white pine and larch types are conspicuous by the relatively low proportions that qualify in the upper class. Productivity of the western white pine type is related to the ecology of blister rust. In order to reduce subsequent direct blister rust control cost, it is necessary, following cutting, to provide sufficient cover to shade out the alternate hosts for the blister rust—currant and gooseberry plants. This

TABLE 50.—*Productivity of recently cut commercial forest land, by forest type group, 1953*

Forest type group	Productivity class		
	Upper	Medium	Lower
Eastern type groups:	*Percent*	*Percent*	*Percent*
White-red-jack pine	56	32	12
Spruce-fir	69	28	3
Longleaf-slash pine	62	19	19
Loblolly-shortleaf pine	55	24	21
Oak-pine	59	23	18
Oak-hickory	54	35	11
Oak-gum-cypress	44	42	14
Elm-ash-cottonwood	40	49	11
Maple-beech-birch	76	20	4
Aspen-birch	84	14	2
All eastern types	60	26	14
Western type groups:			
Douglas-fir	77	19	4
Hemlock-Sitka spruce	90	9	1
Redwood	88	12	--------
Ponderosa pine	73	23	4
Western white pine	20	48	32
Lodgepole pine	89	8	3
Larch	43	43	14
Fir-spruce	73	20	7
Western hardwood	75	25	--------
All western types	75	20	5
All forest type groups	65	24	11

shade is also unfavorable to establishment of western white pine. Consequently, because of the blister rust control problem, forest conditions favorable to prospective stocking with western white pine often are deliberately not created until some time after cutting. Western types that have the largest proportion of recently cut lands in the upper productivity class are hemlock-Sitka spruce, lodgepole pine, and redwood.

Clear Cutting on Small Ownerships

Although clear cutting need not result in lower productivity than partial cutting, that condition was found on small private ownerships under the clear cutting that is now being practiced. Whereas 58 percent of the small private ownerships that are partially cut fall in the upper productivity class, only 32 percent of clear-cut lands in the same ownership group were so classified. Somewhat the same pattern is evident in the medium and large private ownerships, but not with the public lands.

In general, lands cut for a combination of both sawtimber and cordwood products are left in better condition than those cut for either one or the other product alone.

Stocking Deficiencies Most Significant Element in Productivity

Regardless of locality, ownership, or forest type, substandard stocking proved to be the main factor in lowering the index of forest productivity sufficiently to cause recently cut lands to drop out of the upper class. Deficiencies in existing stocking were more pronounced in the South and West than in the North, and in small private ownerships than in large and medium private ownerships or in public ownerships (table 51). For the Nation as a whole, if existing stocking were the only criterion of productivity, over half of the recently cut lands would fail to qualify in the upper productivity class.

Prospective stocking often partially offsets deficiencies in existing stocking. On individual ownerships, prospective stocking might offset lack of existing stocking entirely, but this was not general for any section of the country or for any major ownership group. Prospective stocking was most effective in the West and on the public and large and medium size private ownerships. It was least effective on the small private ownerships. Whereas over half of the recently cut areas in the Nation failed to qualify for the upper productivity class because of deficiencies in actual stocking, a little more than half of this area was returned to the upper class when allowance was made for prospective stocking (table 51). When both existing and prospective stocking were considered, about one-fourth of the recently cut lands would still fail to qualify for the upper productivity class.

Reasons for nonstocking were recorded for parts of the Pacific Northwest where certain additional data were obtained. In that region, the most important reasons for nonstocking appeared to be inhibiting vegetation—especially brush, presence of cull or noncommercial species, or a perennial sod cover—and inadequate seed source. Adverse site conditions, rodents, or other animals were judged to be of less importance.

In all regions, species composition and felling age had much less effect on forest condition than either existing or prospective stocking. However, composition and felling age were more important in the North than elsewhere, and on small private than on other ownerships. On a national basis, deficiencies in species composition were responsible for removing only 4 percent of the recently cut lands from the upper productivity class, and premature cutting had about the same effect.

Species composition was appraised with respect to the proportion of desirable and acceptable species that stocked the area after cutting. If composition of the stand after cutting had been considered in relation to that before cutting, it is possible that composition would have been a more significant element. In Douglas-fir types of the Pacific Northwest, Douglas-fir tended to occupy a smaller proportion of the stand after cutting than before cutting. This was true of recent clear cuttings in all ownerships except the national forests where the proportion of Douglas-fir increased. Similarly, in the ponderosa pine types in the Northwest, ponderosa pine tended to make

TABLE 51.—*Relative effect of various elements in deriving upper productivity percentages*

Section or class	Proportion of operating area deducted (−) or added (+) due to—				Proportion of area in upper productivity class on basis of all elements
	Existing stocking	Prospective stocking	Composition	Felling age	
	Percent	*Percent*	*Percent*	*Percent*	*Percent*
BY SECTION					
North	−40	+23	−8	−8	67
South	−62	+27	−3	−7	55
West and Coastal Alaska	−59	+37	−2	−1	75
All sections	−55	+29	−4	−5	65
BY OWNERSHIP CLASS					
Large and medium private	−49	+30	−4	−4	73
Small private	−62	+19	−6	−11	40
Public	−52	+35	−2	−1	80
All ownerships	−55	+29	−4	−5	65

up a smaller proportion of the stand following cutting than before. These trends indicate that, in some types at least, the more preferred species are being partly replaced in the newer stands with less desirable species.

Contrasts in Productivity

With so many variables, it is difficult to isolate one particular combination that is characteristic of the best condition or of the poorest. In attempting to identify combinations of variables representing relatively good conditions and those representing relatively poor conditions, it is necessary to consider such variables as type of ownership, size of ownership, geographic location, and forest type, all in relation to the proportion of recently cut lands in various productivity classes, the acreage involved, and the number of ownerships.

An effort has been made to select several combinations of these variables which represent both relatively good and relatively poor combinations from the standpoint of forest productivity. In identifying relatively poor or weak areas, an effort was made to select those combinations with relatively large acreages but with small proportions of recently cut lands in the upper productivity class. For relatively good or strong areas, the effort was likewise made to identify large acreages with high proportions in the upper productivity class. Both the strong and the weak areas are shown in figure 38. For both categories, some combinations of variables were chosen on a national basis and others were on a regional or sectional basis. For this reason, there is overlap in the selections, but this is not important because the purpose was to illustrate various combinations of size, kind, and locality of ownership, and forest type, which are significant in terms of acreage, and which are outstanding with respect to either high or low proportions in the upper productivity class.

Productivity Lowest on Small Private, Farm, and "Other" Private Ownerships

Small private ownerships, farm ownerships, and "other" private ownerships represent large acreages, large numbers of ownerships, but relatively small proportions in the upper productivity class (fig. 38). The most significant problems in these categories are in the South.

On a national basis, small private ownerships with 265 million acres of commercial forest land and farm ownerships with 165 million acres each have about 40 percent of their recently cut lands in the upper productivity class. The 4.5 million small private ownerships, of course, include a great many of the 3.4 million farm ownerships.

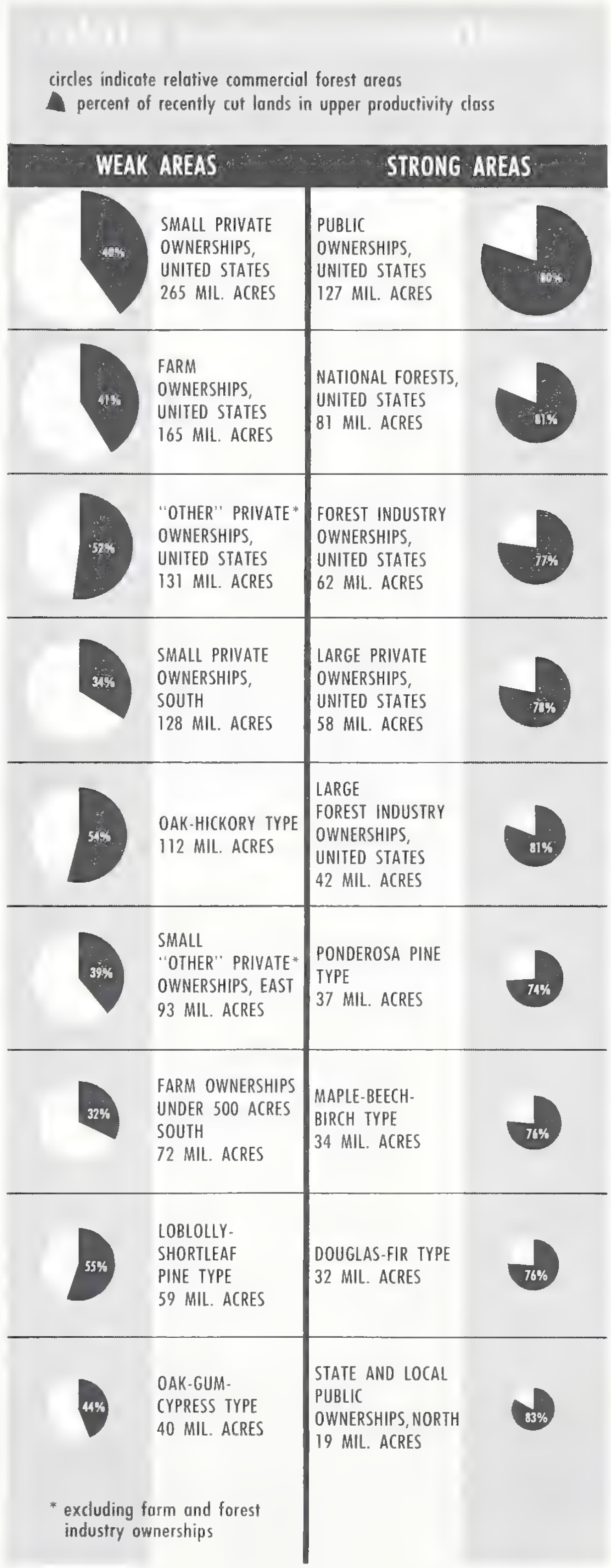


Figure 38

Perhaps the outstanding combination of factors localized to a particular region are the small private ownerships of the South with 128 million acres in 1.8 million ownerships and only 34 percent of the recently cut lands in the upper productivity class (fig. 39).

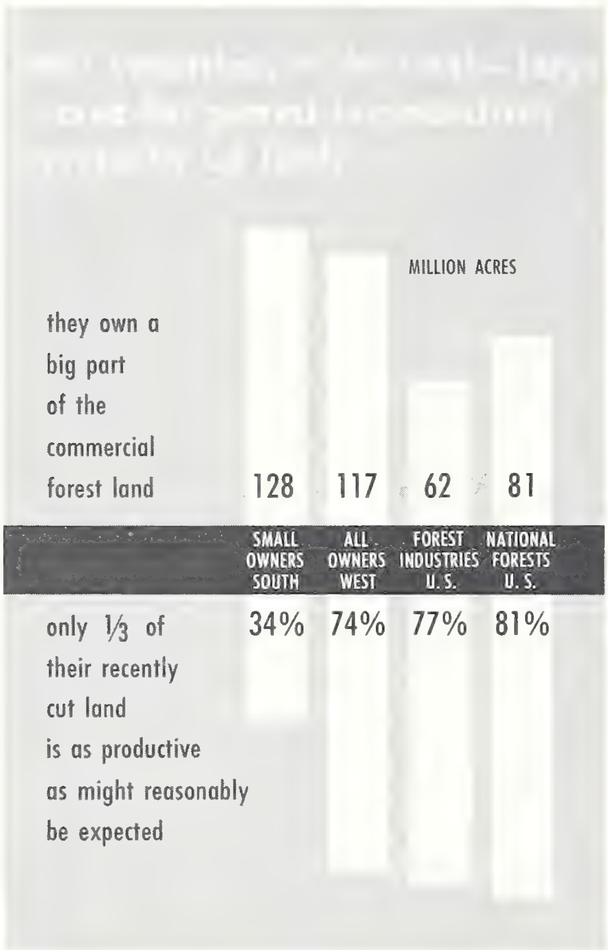


Figure 39

In addition, forest types enter into the picture. There are "weak" areas in the West in Douglas-fir, ponderosa pine, and western white pine on small ownerships and in larch and western white pine in the larger private and public ownerships. The reason for the productivity of western white pine types is explained on page 77. Likewise, major weak areas show up in the East on small ownerships in all types except maple-beech-birch and aspen-birch, and on larger private ownerships in oak-gum-cypress and oak-hickory. Considering all ownerships, the types with substantial acreages and relatively low productivity appear to be oak-gum-cypress, oak-hickory, and loblolly-shortleaf pine.

Productivity Highest on Public, Forest Industry, and Large Private Ownerships

Public ownerships, forest industry, and large private ownerships generally are identifiable with relatively high proportions of the recently cut areas in the upper productivity class. There is considerable overlap between the forest industry and large private categories. It is noteworthy that the strong combinations with high proportions in the upper productivity class, as shown in figure 38, generally are not as large in acreage as the weak area combinations. The number of ownerships involved in forest industry or large private ownerships is a small fraction (less than 1 percent) of those in farm or small private ownerships.

Strong areas can be identified with respect to forest types in the same manner as weak areas in the preceding discussion. The southern pine types on public and medium and large private ownerships in the South, Douglas-fir and ponderosa pine types in the West, and the maple-beech-birch type in the North are pertinent examples.

The combinations illustrated in figures 38 and 39 are only a selected group. Others could be selected. The particular ones chosen demonstrate how the results of the survey of recently cut lands can be used to identify strength and weakness in the forest situation.

The Significance of Ownership

What happens to the timber resources of the United States, both currently and in the future, depends on the individuals who control private timberland and on the policies of Government agencies which control publicly owned timberlands. Subject to such legal requirements as are imposed in some States, the ultimate control of private timberlands is exercised by the owner. When an owner is disinterested or ill informed, other groups such as timber buyers, loggers, or tenants exercise great influence and, in some instances, control for all practical purposes what happens to timber resources on a given property. But fundamentally, the ultimate control rests with the owner. Consequently, the identity of timberland owners, their characteristics, and the forces that motivate their decisions are extremely important in their effect on timber supplies.

For the above reasons, the Timber Resource Review has given special attention to ownership. Some information on ownership of land and timber and on productivity of recently cut lands by kinds of ownership has already been given. The purpose here is to bring together that information in one place and to supplement it with additional information, especially on very small ownerships. Consequently, there is considerable repetition

between this and earlier parts of this summary section. This is believed justified in order to highlight in one place and in summary form the outstanding characteristics and significance of the four major ownership groups: forest industry, farm, "other" private, and public. Many of these characteristics are compared in table 52 and figure 40.

Forest Industry Ownerships

Few in Number and Small in Total Area

There are about 23 thousand forest industry ownerships in the United States, or less than one percent of the total number of private forest land ownerships. In numbers, this group is the smallest of the major ownership groups. About 21 thousand of these owners are engaged in the manufacture of lumber. This estimate should not be confused with the 60 thousand or so sawmills in the United States. Many sawmill operators do not own forest land, but purchase their timber or logs on the open market.

Commercial forest land owned by the forest industries represents 13 percent of the national total. It is a little more than a third as much forest land as owned by farmers, and about half as much as owned by "other" private ownerships or by the public agencies. Lumber manufacturers own 7 percent of all commercial forest land, and pulp manufacturers 5 percent.

Although the total forest land held by forest

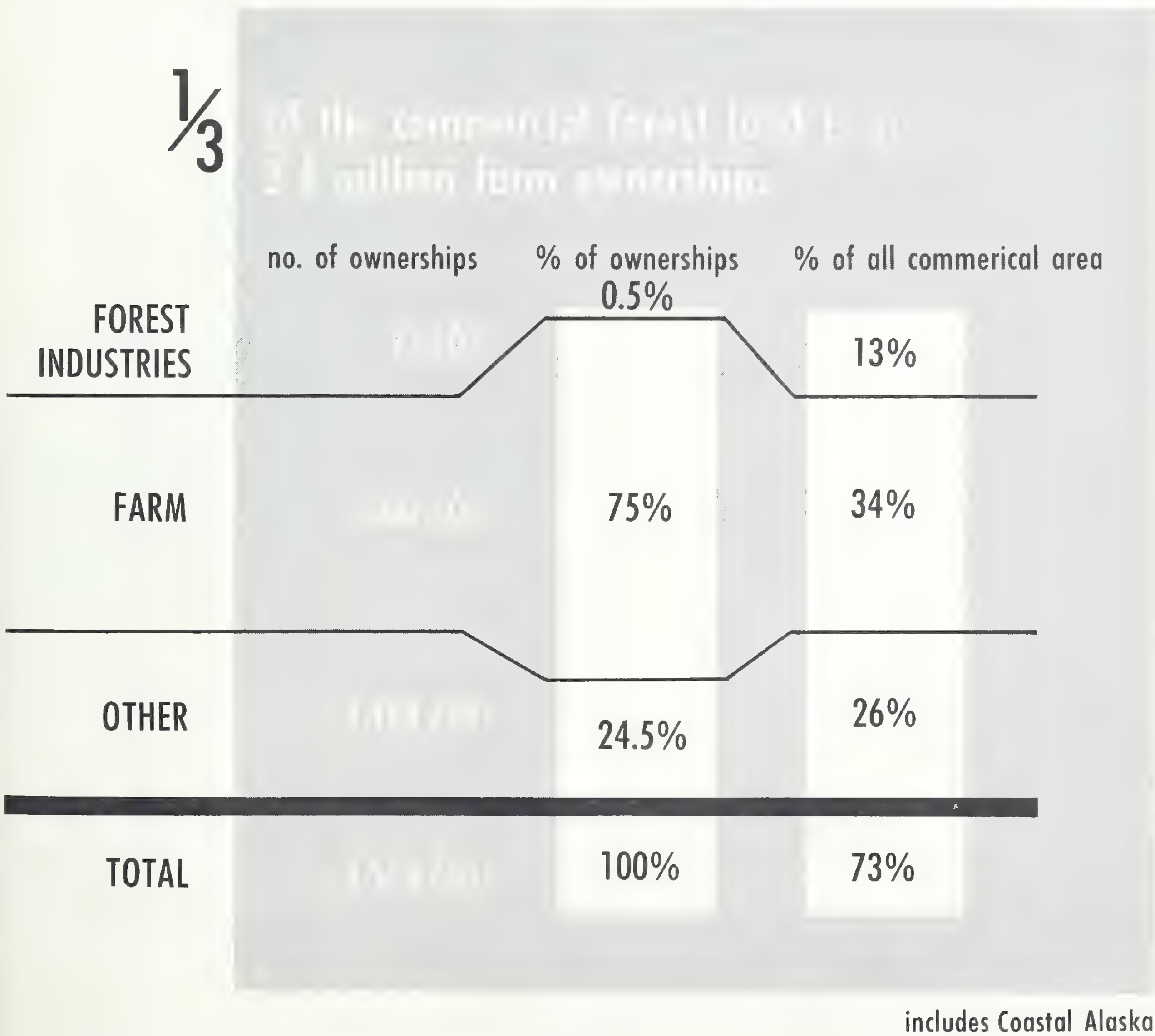


Figure 40

TABLE 52.—*Comparative characteristics of forest ownership in the United States and Coastal Alaska, 1953*

Type of ownership	Number of ownerships		Commercial forest land		Live sawtimber volume				Growing stock	Proportion of recently cut land in upper productivity class
			Area	Average holding	Total	Softwood	Hardwood	Average stand per acre		
	Thousands	*Percent*	*Percent*	*Acres*	*Percent*	*Percent*	*Percent*	*Bd.-ft.*	*Percent*	*Percent*
Private:										
Farm	3, 383	75	34	49	15	9	41	1, 900	20	41
Forest industries:										
Lumber manufacture	21	1	7	1, 630						73
Pulp manufacture	(1)	(1)	5	146, 390						84
Other wood manufacture	2	(1)	1	2, 200						73
Total, forest industries	23	1	13	2, 660	37	35	47	4, 000	39	77
"Other" private	1, 104	24	26	118						52
Total, all private	4, 510	100	73	79	52	44	88	3, 000	59	56
Public:										
National forest			17		37	45	6	9, 000	31	81
Indian			2		2	3	1	6, 500	2	74
Bureau of Land Management			1		4	5	(1)	12, 700	3	80
Other Federal			1		1	(1)	1	2, 000	1	80
Total, Federal			21		44	53	8	8, 700	37	80
State			4		3	3	3	3, 300	3	77
County			2		1	(1)	1	1, 500	1	76
Municipal and local			(1)							93
Total, all public			27		48	56	12	7, 500	41	80
All ownerships			100		100	100	100	4, 200	100	65

[1] Less than 0.5.

TABLE 53.—*Proportion of commercial forest land in private ownership, 1953*

Type of ownership	Size of holding (acres)					
	All sizes	50,000 and larger	5,000–50,000	500–5,000	100–500	Less than 100
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Farm	33. 8	0. 1	0. 9	4. 8	12. 1	15. 9
Forest industries:						
Lumber manufacture	7. 1	3. 8	2. 2	. 6	. 4	. 1
Pulp manufacture	4. 8	4. 5	. 3	(1)		
Other wood manufacture	. 9	. 4	. 5	(1)	(1)	(1)
Total, forest industries	12. 8	8. 7	3. 0	. 6	. 4	. 1
Other private	26. 7	3. 1	3. 2	4. 1	7. 5	8. 8
Total, all private	73. 3	11. 9	7. 1	9. 5	20. 0	24. 8
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Average size of holding	79	206, 067	14, 879	1, 001	167	31

[1] Less than 0.1 percent.

industry is small in relation to other major ownership groups, the average individual forest industry ownership is relatively large—2,660 acres. Lumber industry ownerships average 1,630 acres, and pulp industry ownerships nearly 150,000 acres. About 84 percent of the forest land owned by the lumber industry is in ownerships of 5,000 acres or larger, but the average for the lumber industry is considerably smaller because of the many small manufacturers whose individual acreage is in the smaller size classes. Ninety-four percent of the pulp industry ownership is in holdings of 50,000 acres and larger (table 53).

Of the 58 million acres in ownerships of 50,000 acres and larger, nearly three-fourths is owned by the forest industries. The 283 large ownerships in this class average 206,000 acres. The 7 ownerships of more than 1,000,000 acres apiece average 2,100,000 acres.

Over half (54 percent) of the commercial forest land owned by forest industry is in the South. The remainder is almost equally distributed between the North and the West (table 16 and fig. 41). The lumber industry ownership is concentrated in the South and West; pulp industry ownership in the South and the North (fig. 42).

Timber Volumes Large in Relation to Acreage Owned

Unfortunately, timber volumes for nonfarm private ownership were not separated between the forest industry segment and "other" private ownerships. However, for those ownerships combined, the average stand per acre is 4,000 board-feet of sawtimber. This is more than twice the average stand for farm ownerships, but less than half the average on Federal forests. The latter figure is due in part to the large volumes of old-growth timber which occur on some public land. It is probable that the average stand per acre in forest industry ownerships is higher than that in "other" private which more nearly resembles farm ownerships in other respects.

With respect to total United States softwood sawtimber volume, 35 percent is found in forest industry and other nonfarm private ownerships. This is a larger proportion than on any other ownership except the national forests. Considering the distribution of forest area between forest industries and "other" private, the concentration of industry ownership in the South, and the ownership by industry of some heavily timbered lands in the West, forest industries probably own from 15 to 25 percent of the Nation's softwood sawtimber. If this is a fair inference, it is apparent that forest industry ownerships are a more important factor in timber supply than would be indicated by the relative number of ownerships or the acreage owned.

About 77 percent of recently cut lands in forest industry ownership qualified in the upper productivity class. The pulp industry with an average of 84 percent in the upper class had a higher average percentage than any of the other private ownerships or the public ownerships, with the exception of municipal and other locally owned public holdings, which are small in total area.

Farm Ownerships

Large in Number and Total Acreage

Of the 4.5 million private ownerships of commercial forest lands, 75 percent or 3.4 million are farm ownerships. Farm owners constitute by far the largest number of forest land owners.

One-third of all commercial forest land and close to half of all the privately owned commercial forest land is in farm ownerships; farms have more commercial forest land than all public holdings combined. Of the commercial forest land in the United States, one acre in every three is on a farm.

Not only are farm forests important in supplying our national needs for timber, they also are a vital part of a sound farm economy. About 60 percent of all farms have woodland, and nearly one-fifth of all farm acreage is in forest.

Like forest industry, more than half (54 percent) of the farm forest land occurs in the South. But whereas the remainder owned by forest industries is distributed about equally between West and North, 38 percent of farm ownership occurs in the North, and only 8 percent in the West (table 16). Thus, over nine-tenths of all farm ownership is in the East.

Most Farmers Own Very Small Tracts

The average farm ownership is 49 acres. In contrast, forest industry ownerships average 2,660 acres, and the "other" private ownerships 119 acres.

With respect to size of forest holdings, practically all farm ownerships are less than 5,000 acres. Eighty-three percent of the farm-owned acreage is in tracts of less than 500 acres, and nearly half is in tracts of less than 100 acres (table 54).

Figure 41.—Ownership of private commercial forest land in the United States, and size of holding, 1953.

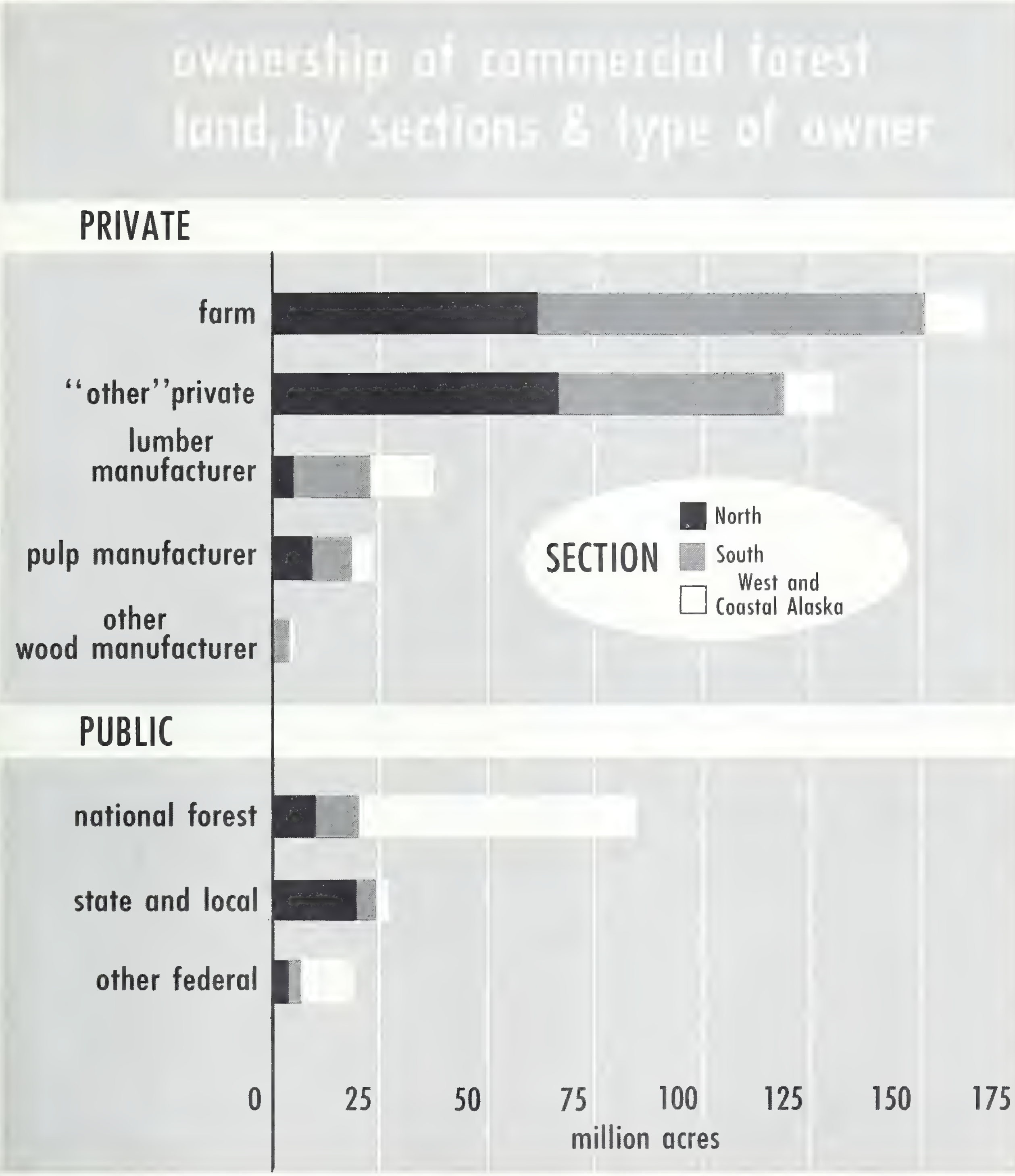

ownership of commercial forest
land, by sections & type of owner
PRIVATE
farm
"other" private
lumber
manufacturer
pulp manufacturer
other
wood manufacturer
SECTION
North
South
West and
Coastal Alaska
PUBLIC
national forest
state and local
other federal
0
25
50
75
100
125
150
175
million acres

Figure 42

TABLE 54.—*Area and numbcr of farm and "other" private ownerships, 1953*

Size of forest holding (acres)	Farm					"Other" private				
	Number		Area			Number		Area		
	Thousands	*Cumulative percent*	*Million acres*	*Cumulative percent*	*Cumulative percent* [1]	*Thousands*	*Cumulative percent*	*Million acres*	*Cumulative percent*	*Cumulative percent* [1]
Less than 10 [2]	671	20	4.2	3	1	125	11	0.9	1	(3)
10 to 20	742	42	10.2	9	3	122	22	1.9	2	1
20 to 30	485	56	11.2	15	5	95	31	2.5	4	1
30 to 40	279	64	9.4	21	7	89	39	3.0	6	2
40 to 50	197	70	8.5	26	9	157	53	6.8	12	3
50 to 75	324	80	18.7	38	13	189	70	11.3	20	5
75 to 100	193	85	15.6	47	16	196	88	16.3	33	9
100 to 500	492	100	59.2	83	28	131	100	36.6	61	16
500 and larger			28.2	100	34			51.4	100	27
All ownerships	3,383	100	165.2	100	34	1,104	100	130.7	100	27

[1] Percent of total commercial forest area in the United States.

[2] East only, 3–10 acres for number of owners; 1–10 acres for area.

[3] Less than 0.5.

From the standpoint of number of owners, it is significant that, of the 3.4 million farmers owning forest land, over half own tracts of less than 30 acres, and two-thirds own tracts of less than 40 acres. Good forest management by the two million farm owners of less than 30 acres apiece would affect only 5 percent of the commercial forest land and a correspondingly small proportion of timber supplies (table 54). More fruitful response in terms of timber growth might accrue from more intensified forestry effort on larger acreages owned by fewer individuals. On the other hand, growth and inventory needed to meet projected timber demands are so high as to suggest that not even 5 percent of the Nation's commercial forest land may be considered unimportant in meeting future timber needs.

Timber Volumes Small in Relation to Acreage Owned

Sawtimber in farm ownerships averages 1,900 board-feet per acre. This is lower than the average for any other major type of ownership. The low stand per acre limits the importance of farm ownerships from the viewpoint of immediate timber supplies. It reflects past overcutting and lack of care, and the need for better management of farm forests in the future.

Although farm ownerships hold one-third of the commercial forest area, they support only 9 percent of the softwood sawtimber. This means that farm forest lands are not nearly as important in meeting current and near-future softwood requirements as might be expected in relation to area owned. On the other hand, farm ownerships support more than their proportional share of hardwood sawtimber—41 percent—and have more hardwood sawtimber than any other major ownership group. Considering both hardwoods and softwoods, farm ownerships have 15 percent of all sawtimber, in contrast to 34 percent of the forest area.

The 41 percent of recently cut farm timberlands in the upper productivity class is lower than the percentage for any other major ownership group, and only half as high as that for pulp ownerships or the national forests. This should be of real concern, not only to farmers themselves but also to forest industries, independent loggers, and buyers who depend on timber from farm holdings, and who are in a position to exercise considerable influence on the condition in which farm forests are left after cutting.

Other Private Ownerships

By "other" private ownerships is meant privately owned forest land which is not in farm or forest industry ownership. It includes a miscellaneous group of owners embracing a large number of occupational pursuits and some nonforest industries such as railroads and mining. This group shows great diversity in such owner characteristics as occupation, tenure, residence on or off the property, and interest, knowledge, and intent with respect to forestry.

Localized studies of this ownership group have been made in New England, Tennessee, Mississippi, Arkansas, Louisiana, and California.[17] However, these studies do not provide a basis for broad generalizations as to the characteristics of

[17] Since preparation of this discussion, additional studies have been published applicable to parts of Michigan and Texas.

such ownerships. Furthermore, which of the various characteristics of "other" private owners are important in relation to forest condition is not known. Among the more common occupations represented are business and professional people, wage and salary earners, housewives, and retired persons. Because this ownership group is so important in terms of numbers and in area of forest land controlled, there is a real need for further identification of its key characteristics that bear on forestry decisions.

The 1.1 million holdings in this group represent one-fourth of all private ownerships and contain one-fourth of all commercial forest land. The "other" private category includes twice the acreage owned by forest industries, is equal to that owned by all public agencies, and is exceeded only by farm ownerships. Half of the total area in this classification occurs in the North, with most of the remainder in the South (table 16).

It is more difficult to characterize the "other" private ownership according to size class than iether forest industry or farm ownerships, probably because of its heterogeneity. Whereas forest industry acreage is clearly concentrated in the medium and large holdings, and farm ownerships in the very small holdings, the "other" private ownerships are more evenly distributed among size classes. Nevertheless, three-fourths of the forest area in this category is in small holdings (under 5,000 acres) and 60 percent is in holdings of less than 500 acres.

The average size of holding is 118 acres, which is over twice that of the average farm holding, but only a small fraction of the average industry holding. The probable explanation of this dispersion is that there are some large holdings in this group which lessen but do not overshadow the influence of the tremendous number of miscellaneous small holdings. It is evident from table 54 that one-half of the 1.1 million ownerships have less than 50 acres each, and account for 3 percent of all commercial forest land.

Combining the farm and "other" private ownerships, 50 percent of the 4.5 million private ownerships have less than 30 acres of forest land apiece, and together they own 6 percent of the commercial forest land (fig. 43).

Although timber volumes were not determined separately for "other" private ownerships, it is believed that they are reasonably similar to farm ownerships in this regard. If so, the timber runs more heavily to hardwoods than to softwoods. Because the "other" private ownerships exceed forest industry ownerships in area by 2 to 1, it can be assumed that the timber volumes held by this group are substantial inasmuch as the two ownerships together have 37 percent of all sawtimber.

About half of the recently cut lands in this ownership classification qualify for the upper productivity class. This is much below the

includes Coastal Alaska

Figure 43

average for forest industry ownership or for public ownerships, but is appreciably more than the average for farm ownership.

Public Ownerships

One-Fourth of Commercial Forest Land Publicly Owned

Public ownerships of commercial forest land comprise one-fourth of the national total—about the same in area as the "other" private ownerships, twice the area owned by forest industry, but significantly smaller than the area in farm ownerships. The principal public ownership, in terms of area and timber volume, is the national forests with 17 percent of the Nation's commercial forest land and 37 percent of the sawtimber volume.

The geographic location of publicly owned forest lands follows a distinctly different pattern from that of farm, forest industry, or "other" private. Public ownership is concentrated in the West because of the overriding influence of the national forests. On the other hand, a majority

of the State, county, and municipally owned forest land occurs in the North. Of all publicly owned commercial forest land, 62 percent is in the West, 25 percent in the North, and 13 percent in the South.

National Forests Mainly Reserved From Public Domain

The great bulk of the national forests is made up of lands reserved from the public domain. Frequently overlooked is the fact that 85 percent of the national forests have never been in private ownership, as indicated by the following summary of national-forest acreage by origin as of June 30, 1956:

	Area	
	Thousand acres	Percent
Reserved public domain	153, 938	85. 0
Purchases	18, 397	10. 2
Exchanges	6, 727	3. 7
Transfers from other Federal agencies	1, 589	. 9
Donations	408	. 2
Total	181, 059	100. 0

National-forest acreages have been reasonably stable in recent years. In fiscal years 1950–56, there was a net increase of 685,000 acres, comprised mainly of exchanges of land for land and some purchases The rate of increase has been steadily downward since the late 1930's and in 1954–55 there was a net decrease in national-forest land of 271,000 acres. These figures demonstrate that the national forests, which comprise the bulk of the publicly owned forest land, are not undergoing significant changes in area. The balance between private and publicly owned forest land is relatively stable at the present time.

Over Half the Softwood Sawtimber Is Publicly Owned

Of outstanding significance is the fact that 56 percent of the softwood sawtimber volume is in public ownership. Although the amount in forest industry ownership is not known, it is believed that public agencies and forest industry together own close to three-fourths of the Nation's softwood sawtimber. Forty-five percent is in the national forests.

Hardwood sawtimber is relatively unimportant on public ownerships—only 12 percent of the national total. The national forests with 17 percent of the commercial forest area have 6 percent of the hardwood sawtimber.

Publicly owned forests average 7,500 board-feet of sawtimber per acre, which is nearly twice the national average. This is due in part to the large residual volumes of old-growth timber on the national forests in parts of the West, and in part to the longtime forest management policies in effect on most publicly owned forest lands.

With respect to national forests alone, there is heavy concentration of both area and volumes in the West. Of the commercial forest land in the national forests, 72 percent occurs in the West, as does 84 percent of the sawtimber volume. The North and South each have 12 percent of the commercial forest land in the national forests, but together support only 5 percent of the sawtimber volume. Coastal Alaska, with 4 percent of the commercial forest area, currently has more than twice the sawtimber volume of all the national forests in the East. The geographic distribution of timber on the national forests will more nearly resemble the acreage distribution after the old-growth timber in the West has been cut and the productivity of the eastern national forests has been more fully restored.

Key Conclusions

The above comparisons show that the greatest advancements in forestry, the best conditions on recently cut lands, and the largest timber volumes occur on lands of the forest industries and public agencies. They also show that the farm and "other" private ownerships have the poorest cut-over conditions, are largest in acreage, and largest in number of owners. Potentially, they are the largest also in timber volumes.

In summary, conclusions with respect to ownership appear to be these:

1. A key to the future timber situation of the United States lies with farmers and other non-forest industry private owners. These ownerships are in greatest need of improvement.

2. Conversely, forest industry holdings and those of the public agencies, although they lead the way with respect to application of forestry, probably will grow not more than half of our long-range future timber supplies.

3. The principal source of softwood supplies, both currently and for some time in the future, is centered in the forest industries and the national forests.

TIMBER SUPPLY OUTLOOK

A major goal of American forestry must be to grow enough timber of the necessary sizes and kinds to meet prospective demands of a growing population. Only by doing this will advantage be taken of the renewable character of the timber resource and thus will its gradual depletion be avoided.

Thus far, this summary section has dealt with (1) The prospective increases in demand for timber products in 1975 and 2000, and (2) the supply of land and timber in 1952–53 with particular reference to such key factors affecting future supplies as growth and utilization, forest protection, planting, productivity of recently cut lands, and forest ownership.

This third and concluding major phase appraises the outlook for timber supplies in relation to prospective demands. It relates supply and demand and thus offers an opportunity to judge timber prospects for the future. This is essential in a long-time undertaking such as forestry where supply cannot be adjusted on a year-to-year basis, and where supplies at any given future time will largely be predetermined by actions taken many years before.

This concluding appraisal relates timber supply and demand. The first two of the following steps offer necessary reference points to the comparisons made in the later steps:

(1) The capacity of the commercial forest land of the United States to grow timber is discussed, and an estimate is made of the growth that could be realized if all such land were, on the average, managed as well as the better managed lands today for comparable sites and types. This estimate of "realizable" growth serves as a benchmark against which to compare present, needed, and prospective growth estimates.

(2) An estimate is made of "timber removal." This is the volume of the timber that would have to be cut to meet lower and medium levels of projected demand, plus an additional removal due to unpredictable catastrophes of nature, loss of commercial forest land from timber production, and unforeseen new uses for wood, none of which are accounted for elsewhere.

(3) The growth and timber inventory needed to sustain estimated timber removals in 1975 and 2000 are estimated and compared to growth and inventory in 1952–53.

(4) Estimates are made of the quantity of standing timber and the amount of growth that might result in 1975 and 2000 if in the interim (a) timber removals each year increased steadily to meet rising demands, and (b) forestry efforts continued to increase as indicated by trends since World War II. The growth and inventory that might be expected under these assumptions are termed "projected growth" and "projected inventory."

(5) Finally an estimate is made of the growth and removal that might be permanently sustained if lower projected timber demands are met until 1975 and thereafter growth and removal are kept in balance, assuming throughout that the application of forestry continues to increase as it has in recent years. This estimate is termed "sustained removal."

Thus the outlook for future supplies is approached from three directions: (1) How much timber growth and inventory will be needed to sustain prospective demands; (2) how much timber growth and inventory is there likely to be by the end of the century if forestry continues to improve and if rising demands are met each year until then; and (3) at what level can supply and demand be balanced if forestry continues to improve as it has recently. Comparisons of how much is needed with how much there is likely to be if assumptions hold, and with how much can be sustained, indicate how easy or difficult it may be to meet growing future needs on a sustained basis.

The subsequent discussion is necessarily concise, and the subject is complex. Involved are two periods of estimation, 1975 and 2000; two levels of projected timber demand, lower and medium; two types of timber growth and inventory, sawtimber and growing stock; and three species groups, western species, eastern softwoods, and eastern hardwoods. No regional estimates are made because they would add to complexity and the estimates are believed not to be sufficiently precise.[18]

In lieu of regional estimates, three species groups are considered which differ in their ability to support timber removal and produce growth. The species groups chosen make it possible to recognize the effects of old-growth timber.

A great many factors affect the timber outlook. For example, a larger timber supply than estimated could result from: More intensive forestry than assumed, including higher standards of stocking; reduction in idle land by shortening the time between harvest and regeneration; better utilization than assumed in woods and mill, including fuller use of cull volumes and hardwood limbs; use of more timber than assumed from nonforest and noncommercial forest land; and reductions in mortality and growth-impact losses beyond those assumed, especially from diseases and insects. In addition, the timber from Interior Alaska might come into the commercial market and imports from Canada might be greater than assumed. All these would add to timber supply.

On the other hand, there are factors that might reduce supply or increase prospective demand beyond that estimated. These could include underestimates of future population, gross national product, and other economic factors that influence demand; unforeseen national emergencies; extraordinary catastrophic losses beyond those accounted for; failure of expected accelerated trends in forestry to actually take place; unexpected reductions in commercial forest land acreage due to unforeseen extension of highways, urban areas, power lines, and reservoirs; priority use of commercial forest land for watersheds, recreation, and other purposes; failure to achieve expected improvements in utilization; new uses and other unforeseen demands for wood. Unassumed changes in prices of timber products in relation to competing materials can materially affect both

[18] The reader who wishes more detailed explanation and discussion of this complex subject should refer to the section on "Timber Supply Outlook," p. 475.

demand and supply and thus alter the timber outlook.

Needed and projected growth and inventory are estimated only for the lower and medium levels of timber demand. None are developed for the upper-level demand projections for timber products because: (1) The projections of growth and inventory related to medium demand for timber products show such wide disparity between needs and expectations (under the assumptions made) that the even greater disparities that would be shown by relating growth and inventory to upper demands for timber products would be of little more than academic interest; and (2) the intensity of forestry that will be needed to sustain even medium demands for timber products is so much greater than what may be expected from a continuation of recent trends in forestry that the even greater intensification necessary to sustain upper timber demands by 2000 probably would not be practical of attainment in such a short period of time.

Growth Capacity

Growth capacity of the Nation's commercial forest lands is not known and means different things to different people. Growth capacity may be viewed as a series of levels somewhat like the rungs of a ladder on the scale of growth possibilities. One such rung or benchmark might be an annual growth of 50 billion cubic feet including 200 billion board-feet of sawtimber, which is the growth that could be obtained if there were proper distribution of age classes and if each acre of forest land in each type and site class were producing as much as the most productive timber stands are today for the respective types and sites. Growth capacity ultimately might be even higher depending upon results of forest genetics research and the use of growth-increasing substances still in experimental stages.

A more practical and conservative concept of growth capacity is the growth that ultimately would be attained if the commercial forest land in each region were placed under the better forest management currently in effect in that region. This is termed "realizable growth" and is estimated at about 100 billion board-feet of sawtimber, 70 percent of which would be softwoods. This estimate was developed locally, region by region, utilizing the best available technical information and judgment of experts familiar with local conditions.

Realizable growth of sawtimber is more than twice the 1952 net growth of 47.4 billion board-feet. In terms of growing stock, the realizable growth of 27.5 million cubic feet is also about twice the 1952 level. Thus, the realizable growth occupies a point on the scale of growth capacity about double the 1952 levels, but well below growth capacities that might be estimated on the basis of more theoretical concepts. Realizable growth is summarized in table 56 by growing stock and sawtimber and by species groups.

Timber Removal

Earlier in this summary section the projected demands for timber were converted to timber cut.[19] The conversion of demand to timber cut is also explained in more detail in the section on Future Demand for Timber. Before estimates can be made of needed and projected growth, one additional step must be taken, i. e., the addition of a "margin" to the timber cut that is needed to meet projected demand. The result is called "timber removal." The only difference between timber cut and timber removal is that the latter includes not only timber cut but also an additional allowance for removals from the inventory commonly referred to as a "margin."

Following are the steps taken to develop estimates of needed growth and inventory in proper order: (1) Projected demand for timber products; (2) the timber cut necessary to supply projected demand; (3) the timber removal necessary to supply timber cut; (4) the growth necessary to supply the timber removal; (5) the standing timber inventory necessary to produce the needed growth. The transition from step 1 to 2 is summarized in table 10 (p. 22). The second, third, and fourth steps are shown in table 55.

A Margin Is Included

The inclusion in timber removal of an allowance or margin in addition to timber cut has proved controversial in the past. One reason for this is that neither the reasons for the margin nor the percentage allowances have been clearly understood. The correct concept of the margin is that it accounts for withdrawals from the timber inventory which are not included in the timber cut. The margin covers three items:

(1) Inventory withdrawals due to natural catastrophes from insects, disease, storm, or fire in excess of the allowance made for mortality due to these causes in estimating net growth. They include events of such extreme severity as to be unpredictable as to time or place of occurrence. For that reason, including regional estimates for catastrophes in the calculations of net growth was not practicable.

(2) Unforeseen new uses for wood. Although foreseeable new uses for wood have been accounted for in projected demand for timber products, the rapidity of new developments in wood utilization during recent years and the renewable character

[19] See discussion under Projected Demand Converted to Timber Cut, p. 21, and table 10.

TABLE 55.—*Projected timber cut, timber removal, and needed growth of growing stock and live sawtimber, by species groups, 1975 and 2000*

Item	Growing stock				Live sawtimber			
	Timber cut [1]	Margin [2]	Timber removal	Needed growth [3]	Timber cut [1]	Margin [2]	Timber removal	Needed growth [3]
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*
1952:								
Eastern hardwoods	3. 2		3. 2	7. 0	12. 2		12. 2	19. 1
Eastern softwoods	3. 8		3. 8	4. 4	14. 1		14. 1	17. 0
Western species	3. 8		3. 8	2. 8	22. 5		22. 5	11. 3
Total	10. 8		10. 8	14. 2	48. 8		48. 8	47. 4
Lower projected demand:								
1975:								
Eastern hardwoods	4. 0	0. 2	4. 2	4. 1	15. 0	0. 7	15. 7	15. 6
Eastern softwoods	3. 8	. 2	4. 0	5. 0	15. 0	. 7	15. 7	24. 4
Western species	4. 6	. 2	4. 8	3. 9	26. 0	1. 4	27. 4	18. 8
Total	12. 4	. 6	13. 0	13. 0	56. 0	2. 8	58. 8	58. 8
2000:								
Eastern hardwoods	5. 3	. 8	6. 1	6. 0	19. 3	2. 9	22. 2	22. 0
Eastern softwoods	5. 4	. 8	6. 2	6. 8	21. 7	3. 2	24. 9	32. 3
Western species	5. 0	. 7	5. 7	5. 2	28. 0	4. 2	32. 2	25. 0
Total	15. 7	2. 3	18. 0	18. 0	69. 0	10. 3	79. 3	79. 3
Medium projected demand:								
1975:								
Eastern hardwoods	4. 4	. 2	4. 6	4. 5	17. 7	. 7	18. 4	18. 3
Eastern softwoods	4. 4	. 2	4. 6	5. 7	17. 4	. 7	18. 1	28. 2
Western species	5. 2	. 2	5. 4	4. 4	30. 3	1. 4	31. 7	21. 7
Total	14. 0	. 6	14. 6	14. 6	65. 4	2. 8	68. 2	68. 2
2000:								
Eastern hardwoods	6. 6	. 8	7. 4	7. 3	26. 5	2. 9	29. 4	29. 1
Eastern softwoods	6. 8	. 8	7. 6	8. 3	30. 0	3. 2	33. 2	43. 1
Western species	6. 3	. 7	7. 0	6. 4	38. 6	4. 2	42. 8	33. 2
Total	19. 7	2. 3	22. 0	22. 0	95. 1	10. 3	105. 4	105. 4
Upper projected demand: [4]								
2000:								
Hardwoods	8. 1				31. 5			
Softwoods	15. 3				79. 5			
Total	23. 4				111. 0			

[1] Totals for 1975 and 2000 brought forward from table 10.
[2] No margin for 1952.
[3] Net annual growth 1952; elsewhere this column shows needed growth.
[4] No projections made of margin, removal, or needed growth.

of the timber resource, indicate that there may be demands for wood within the next 50 years which have not been foreseen. To the extent that withdrawals are made for this purpose, they will be additions to timber cut.

(3) Withdrawal of land from commercial timber production. The long-time trend in the acreage of commercial forest land in the United States has been downward. It is reasonable to expect that urban expansion, the construction of additional highways and reservoirs, and priority need of forest land for watersheds and recreation will continue to decrease the acreage devoted to growing commercial timber crops. If the remaining land is to grow the timber needed, the inventory on that land must be built up. Consequently, the total growth needed must be sufficient not only to supply the timber cut, but also to build up the inventory on the remaining land to the extent needed to offset the reductions in inventory due to the elimination of land from forest production.

The same margin was used for both the lower

and medium projected timber demands. The estimated margin gradually increased from zero in 1953 to a maximum in 2000 of 15 percent of the sawtimber cut related to lower projected demand for timber products. The sawtimber margin in relation to the medium projected demand for timber products increased from zero in 1953 up to 11 percent by 2000. The margin was increased with the passage of time because of the likelihood that unforeseen new uses of wood and withdrawals of land from commercial timber production would gradually increase as population pressures intensify.

In absolute amounts the allowances added to timber cut were 2.8 and 10.3 billion board-feet of sawtimber in 1975 and 2000, respectively (table 55). From 1953 to 2000 the margin averaged slightly more than 5 percent of the sawtimber cut in relation to both lower and medium projected demands as shown below:

Period or year:	*Margins in percent of sawtimber cut*	
	Lower projected demand	*Medium projected demand*
1953	0	0
1953–1964	1	1
1965–1974	4	3
1975	5	4
1975–1984	7	6
1985–1999	12	9
2000	15	11
Average	6. 5	5. 2

Timber Removal Larger Than 1952 Cut

Projected timber removal is substantially greater than 1952 timber cut because projected timber demand is much larger than 1952 consumption (table 55). For example, projected sawtimber removal for all species to meet the medium projected demand for timber products is 40 and 116 percent greater, respectively, in 1975 and 2000 than was 1952 timber cut. These and other relationships by species groups and for both lower and medium projected timber demand are as follows:

	Change in sawtimber removal from 1952 cut	
	1975 (percent)	*2000 (percent)*
Medium timber demand:		
Eastern hardwoods	+51	+141
Eastern softwoods	+28	+135
Western species	+41	+90
All species	+40	+116
Per capita	+2	+23
Lower timber demand:		
Eastern hardwoods	+29	+82
Eastern softwoods	+11	+77
Western species	+22	+43
All species	+20	+63
Per capita	−12	−7

In terms of growing stock, the relation of projected timber removal to 1952 timber cut is very similar to the above percentage changes for sawtimber. For example, in terms of medium timber demand, projected timber removal for all species in 1975 and 2000 is 36 percent and 104 percent greater, respectively, than timber cut in 1952.

Although these are large absolute increases, when considered on a per capita basis the indications are quite different. Thus although sawtimber removal in 1975 at the medium timber demand would be 40 percent greater than the 1952 cut, it represents only a 2 percent increase per capita. Likewise the 116 percent increase in 2000 over 1952 corresponds to a 23 percent increase per capita. For the lower timber demand, the increases of 20 and 63 percent in 1975 and 2000 are equivalent to per capita decreases of 12 and 7 percent.

Needed Growth and Inventory

Having now developed some indications of growth capacity and having summarized the timber removals needed to meet future timber demand, it is possible to make the first of three basic comparisons. This is the amount of growth and inventory needed to sustain future timber demands in relation to 1952 growth and 1953 inventory. The two other basic comparisons are listed in steps 4 and 5 at the beginning of the discussion of timber supply outlook.

Estimates of needed growth in relation to 1952 growth, realizable growth, and projected growth (to be discussed later) are all summarized in table 56. One of the most significant overall findings is that the growth of sawtimber in 2000 needed to sustain medium projected timber demands is about 105 billion board-feet. This is reasonably close to the realizable growth of 101 billion board-feet, and both are a little more than twice the 1952 growth. The sawtimber growth needed by the end of the century appears to be reasonably attainable because it is close to the estimate of realizable growth.

Needed Growth Much Larger Than 1952 Growth

The needed growth to meet medium timber demands would be 68 and 105 billion board-feet of sawtimber in 1975 and 2000, respectively. These are increases of 44 and 122 percent over 1952 levels (tables 56 and 57, fig. 44). Growth needs to meet lower level timber demands for the same years would be 59 and 79 billion board-feet, or increases over 1952 of 24 and 67 percent. Sawtimber growth of each of the three species groups likewise would need to increase over 1952 to meet either the lower or medium projected timber demands by 2000. Of most significance is the estimate that growth of eastern softwood sawtimber would need to increase either 90 or 154 percent over 1952 in order to meet lower or

TABLE 56.—*Timber growth, 1952, realizable growth, needed growth, and projected growth*

Item	Growing stock				Live sawtimber			
	Total	Eastern hardwood	Eastern softwood	Western species	Total	Eastern hardwood	Eastern softwood	Western species
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*
Net annual growth, 1952	14. 2	7. 0	4. 4	2. 8	47. 4	19. 1	17. 0	11. 3
Realizable growth	27. 5	10. 2	9. 7	7. 6	100. 7	30. 5	39. 6	30. 6
Needed growth:								
Lower projected demand:								
1975	13. 0	4. 1	5. 0	3. 9	58. 8	15. 6	24. 4	18. 8
2000	18. 0	6. 0	6. 8	5. 2	79. 3	22. 0	32. 3	25. 0
Medium projected demand:								
1975	14. 6	4. 5	5. 7	4. 4	68. 2	18. 3	28. 2	21. 7
2000	22. 0	7. 3	8. 3	6. 4	105. 4	29. 1	43. 1	33. 2
Projected growth:								
Lower projected demand:								
1975	18. 2	9. 1	5. 4	3. 7	61. 1	24. 1	20. 7	16. 3
2000	19. 1	9. 4	5. 5	4. 2	66. 7	25. 6	23. 0	18. 1
Medium projected demand:								
1975	16. 9	8. 7	4. 6	3. 6	58. 6	22. 6	20. 1	15. 9
2000	12. 2	7. 9	. 6	3. 7	25. 2	12. 2	([1])	13. 0

[1] Negligible.

medium timber demands in 2000. Also significant are the growth increases needed for western species which are larger percentagewise than are the needed increases for either eastern hardwoods or eastern softwoods.

In terms of growing stock, needed growth of all species to meet medium timber demands in 1975 would be only slightly more than 1952 growth, but by 2000 a 55-percent increase would be needed. Growing-stock growth of eastern softwoods would need to increase over 1952 rates in order to meet either lower or medium timber demands in both 1975 and 2000 (table 56). Percentage increases for western species are greater than for either of the eastern species groups.

TABLE 57.—*Relation of needed growth of sawtimber to 1952 growth*

Species group	Change in growth from 1952 growth			
	1975		2000	
	Lower projected demand	Medium projected demand	Lower projected demand	Medium projected demand
	Percent	*Percent*	*Percent*	*Percent*
Eastern hardwoods	−18	−4	+15	+52
Eastern softwoods	+44	+66	+90	+154
Western species	+66	+92	+121	+194
All species	+24	+44	+67	+122
Per capita	−9	+5	−4	+27

The needed sawtimber growth increases of 67 and 122 percent for all species in 2000 (table 57) seem very large. When considered on a per capita basis, however, they appear in different perspective. For example, even if growth were increased 67 percent over 1952 to meet the lower timber demand by 2000, this would correspond to a 4-percent per capita decrease. Even in 1975 the 24-percent increase in needed sawtimber growth over 1952 to meet the lower timber demand would be equivalent to a 9-percent per capita decrease. To meet medium timber demand, the 122-percent increase by 2000 on a per capita basis becomes a 27-percent increase (table 57).

The reasonableness of the estimates of needed growth therefore is more readily apparent when they are expressed on a per capita basis. It would certainly seem that the growth needed to sustain medium timber demands by 2000 is attainable when it means only growing about 25 percent more sawtimber per person than was grown in 1952 and when it is recalled that the needed growth is about the same amount as would be grown if the commercial forest lands were managed in about the same way on the average as are the better managed lands today.

Needed Growth and Timber Removal Unbalanced by Species Groups

Needed growth is synonymous with timber removal insofar as national totals of hardwoods and softwoods are concerned. But timber removal and needed growth are not the same with respect to individual species groups because ability to support removal throughout the projection period

Figure 44

differs from growing capacity (table 55). Timber removal is distributed to the three species groups in accordance with the ability of each group to support removal during the next half century with the least impairment of prospects for future growth. On the other hand, needed growth is a distribution of the national totals of timber removal estimates between species groups in accordance with the relative realizable growth. Differences in timber removal and needed growth are important and apparent in the softwood species groups, but are not important in hardwoods.

The differences between needed growth and timber removal for selected species groups are brought out by the percentage comparisons for sawtimber as shown in table 58. The basic estimates from which these percentage comparisons were drawn come from table 55.

TABLE 58.—*Proportion of sawtimber removal and needed sawtimber inventory and growth by selected species groups*

Item	Needed inventory	Timber removal	Needed growth
1952:	*Percent*	*Percent*	*Percent*
Eastern softwoods	[1] 12	[2] 29	[3] 36
Western species	[1] 70	[2] 46	[3] 24
Aggregate	82	75	60
Medium projected demand:			
1975:			
Eastern softwoods	35	27	41
Western species	38	46	32
Aggregate	73	73	73
2000:			
Eastern softwoods	35	31	41
Western species	38	41	31
Aggregate	73	72	72

[1] Actual inventory as of Jan. 1, 1953.
[2] Actual timber cut in 1952.
[3] Net growth during 1952.

For all softwoods combined (eastern softwoods and western species) the needed growth should increase from 60 percent of all species in 1952 to 72–73 percent in 1975 and 2000. On the other hand, softwoods hold fairly steady from about 75 percent of the cut in 1952 to 72–73 percent of the timber removal in 1975 and 2000.

Changes between the eastern and western softwood groups are also significant. The needed growth of eastern softwoods in 1975 and 2000 will make up a higher proportion of needed growth of all species (41 percent) than it does of timber removal of all species (27 and 31 percent). The reverse is true for western species. With the

passage of time western species will make up an increasing proportion of growth but a decreasing proportion of timber removal and of inventory.

The differences between needed growth and timber removal by species groups are less in 2000 than in 1975, showing that progress is assumed in achieving necessary inventory adjustments but that the adjustment is not fully completed. Eventually timber removal and needed growth should be the same not only for national totals but for each species group.

Adjustments in Inventory Are Needed

Considering only national totals, the changes in sawtimber inventory needed in 1975 or 2000 to sustain needed growth are not so pronounced in relation to 1953 as were needed growth adjustments. Total sawtimber inventory could adjust downward to meet either lower or medium timber demand in 1975 and to meet lower timber demand in 2000 (table 59). To meet medium timber demand in 2000, however, about a 36-percent increase in sawtimber inventory over 1953 is projected. On a per capita basis, decreases in sawtimber inventory are shown for both 1975 and 2000, and for both lower and medium timber demand.

The above overall indications may be particularly misleading with respect to inventory adjustments unless species groups are considered. An analysis by species groups shows that changes in needed sawtimber inventory would be both at different rates and in different directions than changes in needed growth. Eastern softwoods, for example, show that upward adjustments in inventory must be much greater than the needed adjustments in growth. Eastern softwood inventory needs to increase 300 percent by 2000 to meet the medium projected timber demand in contrast to a needed increase of 154 percent in growth. On the other hand, western species show that inventories could decrease while growth needs to increase.

TABLE 59.—*Relation of needed sawtimber inventory to 1953 inventory*

Species group	Change in inventory from 1953 inventory			
	1975		2000	
	Lower projected demand	Medium projected demand	Lower projected demand	Medium projected demand
	Percent	*Percent*	*Percent*	*Percent*
Eastern hardwoods	−6	+27	+32	+102
Eastern softwoods	+86	+162	+147	+301
Western species	−58	−52	−45	−26
All species	−32	−12	−8	+36
Per capita	−50	−36	−47	−22

There are several reasons for these differing rates and directions of change as between needed inventory and needed growth. The reasons also explain why the total inventory adjustment for all species combined is in several instances downward. Eastern softwood inventory of course must be built up to higher levels to sustain the increase in needed growth. On the other hand, western old-growth softwood sawtimber stands must, after harvesting, be replaced by young growth well distributed as to age classes. This young timber will have much less inventory volume but will sustain much higher growth than is now the average in the West with the substantial acreage of old-growth stands supporting large volumes and little or no growth. Both the building up of eastern softwood inventory and better distribution of age classes of western softwood inventory through orderly harvesting and reduction of old growth are essential in order to produce on a sustained basis the growth needed.

In terms of growing stock, needed adjustments indicate inventory increases in eastern softwoods and decreases in western species for both medium and lower timber demand in both 1975 and 2000. Total growing-stock inventory would need to increase only to sustain the medium demand in 2000.

Needed inventory in relation to both 1953 inventory and projected inventory (discussed later) is shown in table 60 by species groups, by sawtimber and growing stock, for both lower and medium timber demand, and in 1975 and 2000. The most significant inventory needs are that eastern softwood sawtimber inventory should increase four times by 2000 to meet medium timber demands and the western softwood inventory should decrease by 25 percent if accompanied by proper adjustment in age classes. If such changes were to occur, they would mean that eastern softwoods instead of making up 12 percent of the sawtimber inventory of the Nation as in 1952 would increase to 35 percent by 2000. Western species correspondingly would drop from 70 percent of the total sawtimber inventory to 38 percent of the total (table 58).

PROJECTED GROWTH AND INVENTORY

Estimates of the growth and inventory needed to sustain future demands and the relation of this needed growth and inventory to 1952 have just been summarized. A much more significant comparison, however, is the relationship of needed growth and inventory to the growth and inventory that might be expected in 1975 and 2000 if rising timber demands are met each year and if recent

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TABLE 60.—*Timber volume, 1953, needed inventory, and projected inventory*

Item	Growing stock				Live sawtimber			
	Total	Eastern hardwood	Eastern softwood	Western species	Total	Eastern hardwood	Eastern softwood	Western species
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*
Inventory, 1953	517	151	74	292	2, 057	381	242	1, 434
Needed inventory:								
Lower projected demand:								
1975	372	104	110	158	1, 404	358	449	597
2000	511	152	147	212	1, 894	503	598	793
Medium projected demand:								
1975	416	114	124	178	1, 808	482	635	691
2000	627	186	181	260	2, 796	769	970	1, 057
Projected inventory:								
Lower projected demand:								
1975	604	241	96	267	2, 041	542	310	1, 189
2000	709	357	116	236	2, 002	732	385	885
Medium projected demand:								
1975	573	230	82	261	1, 934	498	292	1, 144
2000	499	289	7	203	968	366	(1)	602

[1] Negligible.

trends in forestry continue. This comparison is the most basic of the entire report.

In projecting growth and inventory two basic assumptions are made. These assumptions must be fully understood and borne in mind throughout the subsequent comparisons in order that conclusions drawn will not be misleading. These assumptions are (1) annual timber removal would climb steadily from 1952 to meet the removal necessary to supply demand in each year until 2000, and (2) progress in forestry would continue as indicated by recent trends so that by 2000 it would be considerably more widespread and intensive than in 1952.

The assumptions with respect to forestry are not that forestry would continue at the same intensity as in 1952. The assumption is that forestry will continue to intensify and expand between 1952 and 2000 at about the same rate that it has been intensifying and expanding during the years immediately preceding 1952. This assumption as to acceleration in forestry is tangibly expressed in terms of higher growth and lower mortality rates. Growth projections were made at periodic intervals between 1952 and 2000. The last growth projection interval began in 1985. The assumption for this last period under medium timber demand was a gross growth rate 25 percent higher and a mortality rate 22 percent lower than 1953 rates (table 290, p. 486).

The assumption that annual timber removal would climb steadily from 1952 to meet the removal necessary to supply demands each year until 2000 also needs interpretation. The theoretical application of this assumption to medium projected timber demand results in great excesses of timber removal over growth as the year 2000 approaches. As explained later, the large disparity between projected and needed growth by 2000 should be considered as indicative only and not suggestive of a timber famine. The most useful purpose that such projections serve is to indicate the magnitude of the forestry effort that will be needed to reduce the gap between growth and removal if we are to sustain timber demands at reasonable prices.

In appraising projected growth and inventory, consideration is given to (1) projected growth in relation to needed growth; (2) the level at which growth and removal could be sustained in balance if forestry trends accelerate as assumed; (3) the outlook for timber quality; and (4) projected inventory in relation to needed inventory.

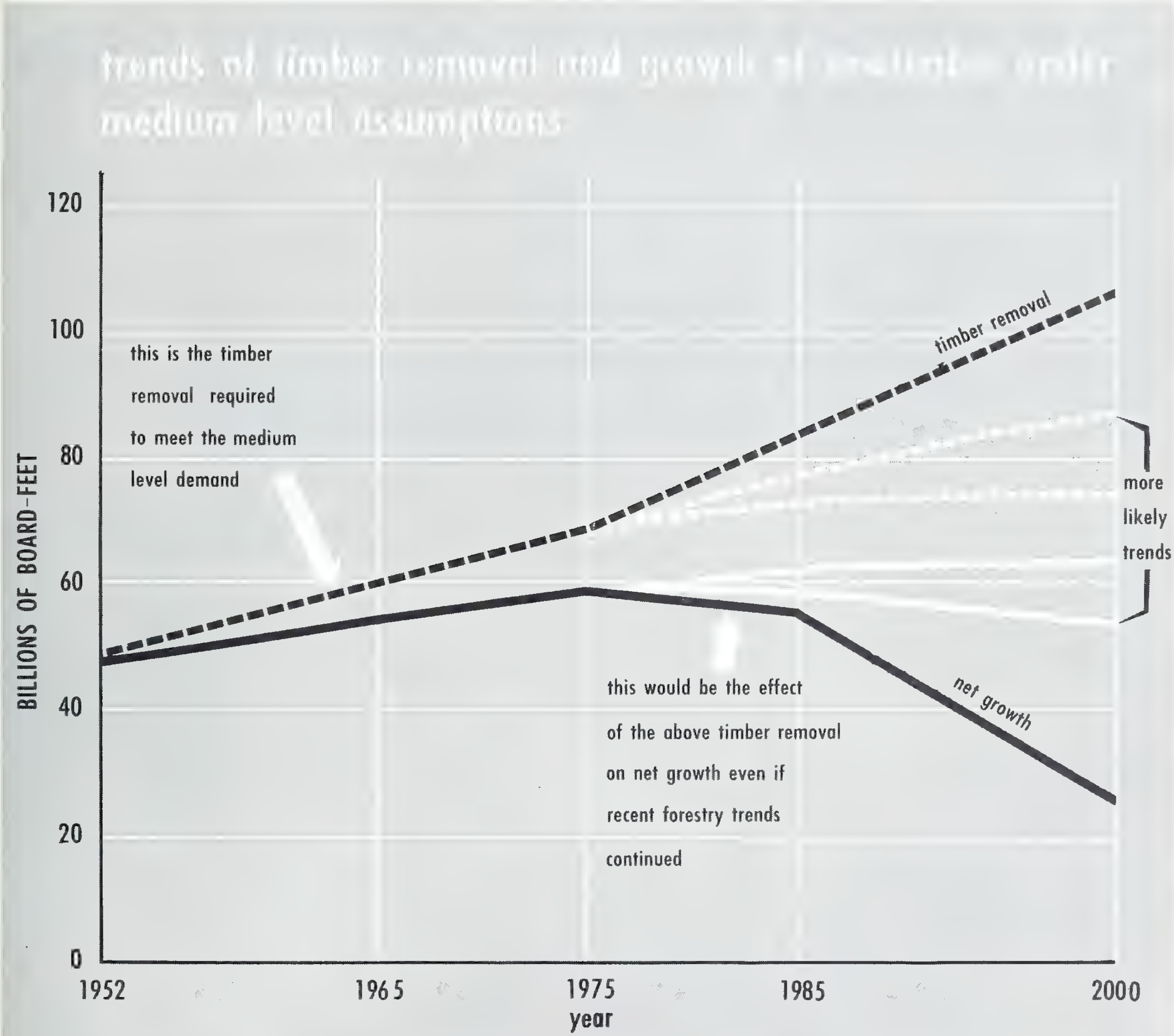
Projected Growth Far Short of Needs If Medium Demands Are Met

Estimates of projected growth are summarized in table 56 by species groups for sawtimber and growing stock, and for both lower and medium projected timber demand in 1975 and 2000. These estimates of projected growth also may be readily compared with comparable estimates of needed, realizable, and 1952 growth in table 56.

The interpretations given to these projections of future growth are perhaps the most important in the entire Timber Resource Review. The projections indicate that if medium levels of timber demand are met each year, sawtimber growth by 1975 would show a 14-percent deficit in relation to needed growth and a 76-percent deficit by the

year 2000 (table 61 and fig. 45). Eastern hardwood sawtimber would show a surplus of growth in 1975 but a deficit by 2000. Both eastern softwoods and western species would show very substantial deficits in both years.

If the lower instead of the medium level of timber demand was met each year there would appear to be a slight surplus of sawtimber growth, considering all species together, in relation to needed growth in 1975 but a 16-percent deficit by 2000. Projected growth of eastern hardwood sawtimber would be in excess of growth needed in both years. But both eastern softwoods and western species would show about a 15-percent deficit of projected growth in relation to growth needed in 1975. This discrepancy would about double by 2000 (tables 55 and 61, figs. 46 and 47).



If the assumptions basic to this projection prevail for the next two or three decades, timber removal and net growth thereafter will more closely approach each other than indicated by the heavy lines above. Trends toward limited supplies resulting from inadequate growth will reduce timber removal below amounts needed to supply projected demands. On the other hand higher prices caused by limitations in supply will stimulate forestry and the decline in growth would be modified by this and reduced removal.

Figure 45

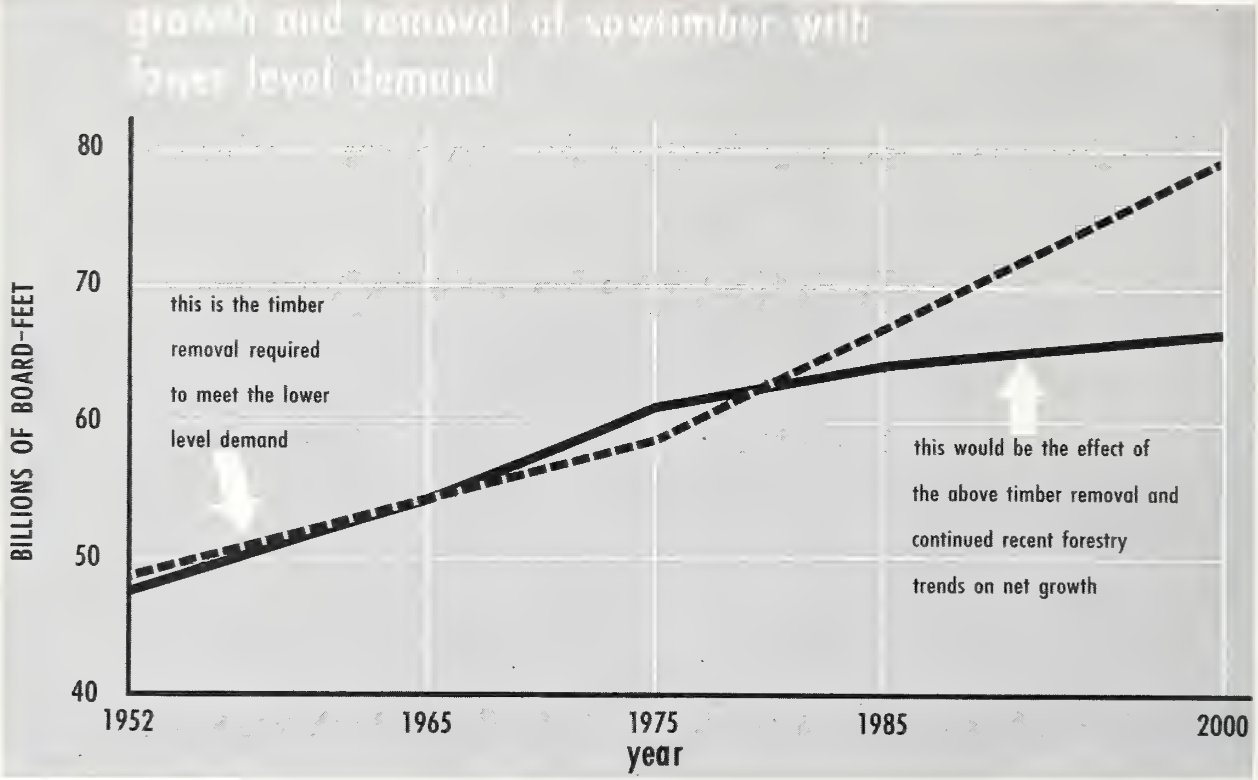


Figure 46

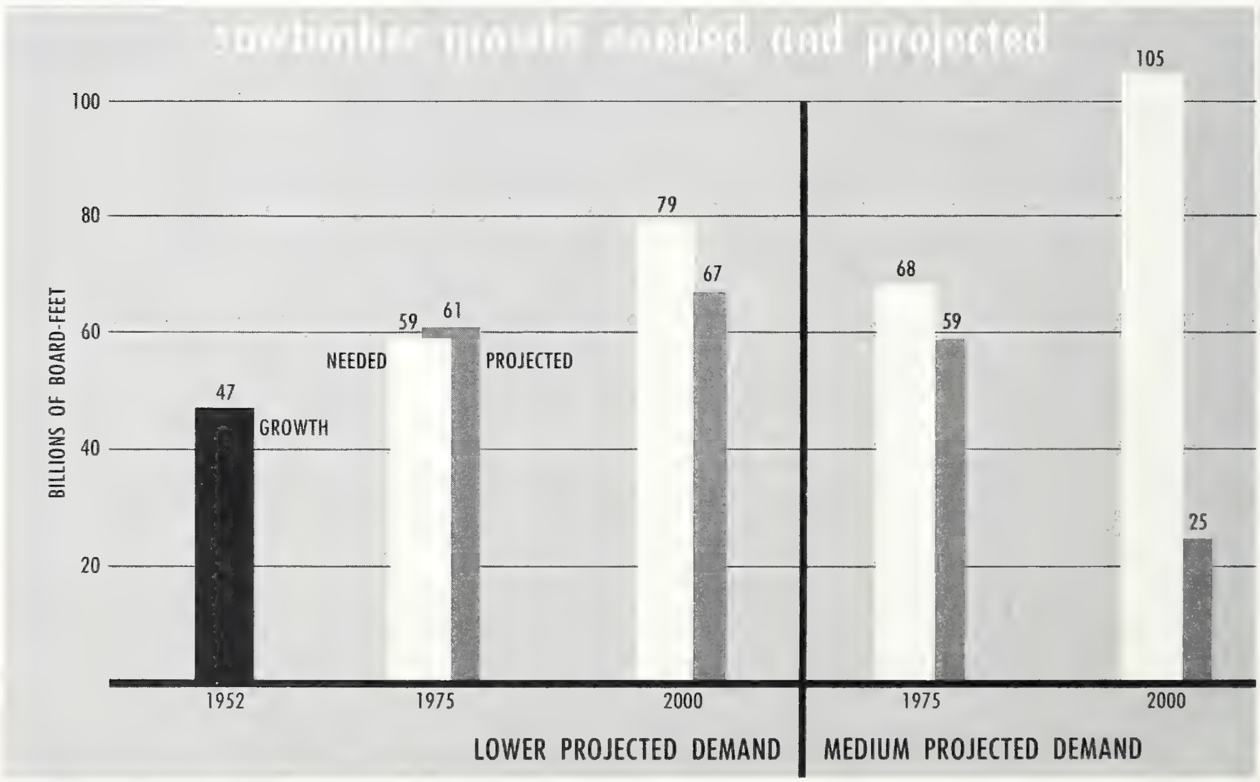


Figure 47

TABLE 61.—*Relation of projected sawtimber growth to needed growth, 1975 and 2000*

Species group	Change in projected growth from needed growth			
	1975		2000	
	Lower projected demand	Medium projected demand	Lower projected demand	Medium projected demand
	Percent	*Percent*	*Percent*	*Percent*
Eastern hardwoods	+54	+23	+16	−58
Eastern softwoods	−15	−29	−29	[1]
Western species	−13	−27	−28	−61
All species	+4	−14	−16	−76

[1] Under the assumptions, projected growth would be negligible (table 56); thus the theoretical percentage change from needed growth would approach a minus 100 percent.

The above indications must be interpreted with care, especially those pertaining to 2000 and the indicated sawtimber growth in that year if medium timber demands are met. The reason for difficulty in correctly interpreting projected growth is that when the gap between projected and needed growth becomes sufficiently large, additional economic forces will modify projected timber removal and net growth.

No one knows at exactly what point or when net growth would become so low in relation to needs that timber removal would be less than assumed. It is realistic to expect, however, that at some point prices would rise, timber removal would become less than assumed, forestry would intensify at a greater rate than assumed, growth and timber supply would become larger, and thus the gap between projected growth and needed growth would become less. The trends of timber removal and growth that are believed more likely to actually occur after 1975 are also shown in figure 45. Nevertheless, carrying these projections of growth through 2000 under the basic assumptions of meeting timber demand each year and a continuation of forestry trends has real value, because it demonstrates that medium timber demands will not be met unless forestry efforts are intensified and expanded much more rapidly than has occurred during recent years.

The projections of growth also make it apparent that either the medium or lower level of timber demands could be sustained reasonably well until 1975 in terms of total sawtimber growth. However, even by then there could be a softwood sawtimber deficit of growth in relation to needs of about 15 percent if lower timber demands were met each year and 29 percent if medium demands were met.

Projected growth of growing stock shows similar trends to those for sawtimber although not so pronounced. If medium timber demands were met every year there would be a surplus of growing-stock growth in 1975 of 16 percent in relation to growth needed, but a 45-percent deficit by 2000. Softwoods would show about a 20-percent deficit in 1975 and a much greater gap by 2000.

Lower Timber Demands Would Not Be Met If Growth and Removal Kept in Balance

In view of the indicated deficit of projected growth in relation to growth needed if either the lower or medium timber demands are met continuously after 1975, the question naturally arises: What sawtimber removal can be sustained after 1975 if a balance is struck and forestry accelerates as suggested by recent advancements? In order to develop such an estimate at as high a point as possible, assumptions with respect to intensification of forestry were held the same as for the preceding projections of timber growth, but estimates of timber removal were made as favorable as possible by assuming a further substantial switch in patterns of consumption from softwoods to hardwoods.

In the projections of demand for timber products, there was included as much transfer of demand from softwoods to hardwoods as believed might reasonably occur. Whereas hardwoods made up about 20 percent of the 1952 consumption, it was estimated that by 2000 they would comprise about 30 percent. In the projections of sustained removal, it was assumed that all excess sawtimber hardwood growth would be utilized and that removal of softwood sawtimber would never exceed combined growth of eastern softwoods and western species. This sudden switch in consumption patterns assumed to occur between 1975 and 1985 is probably not realistic but was done in order to develop as high a level of sustained sawtimber removal as theoretically possible.

Projected sawtimber growth and timber removal would be approximately in balance until 1975 if lower timber demands were met (table 61 and fig. 46). For this reason the projections as to sustained timber growth and removal under the modified assumptions explained above do not start until after 1975. The projections of sustained sawtimber removal and their relation to sawtimber removal needed to supply lower timber

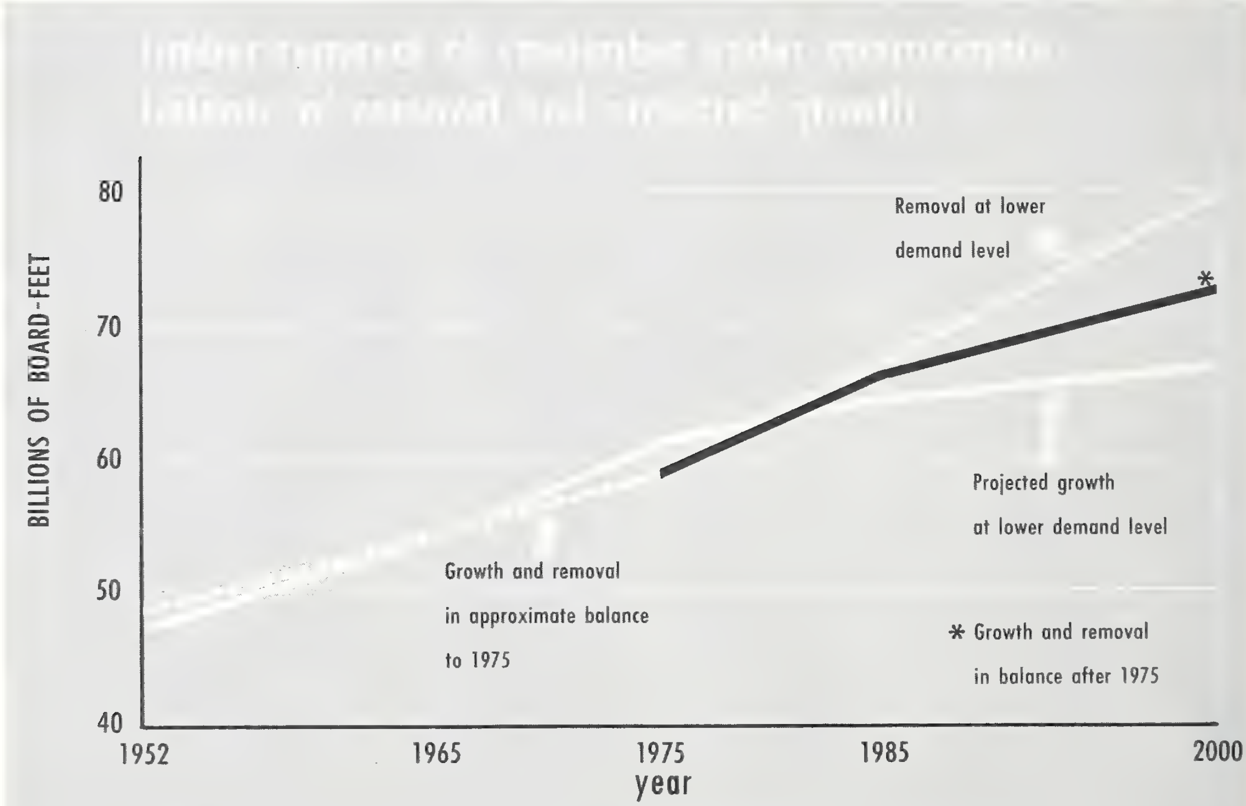
demands in 2000 are shown in figure 48 and the following tabulation:

	Sawtimber removal needed to supply lower timber demands (billion bd.-ft.)	*Sustained sawtimber removal (billion bd.-ft.)*	*Difference (percent)*
Softwoods [1]	57.1	47.7	−16
Eastern hardwoods	22.2	24.5	+10
Total	79.3	72.2	−9

[1] Includes a small volume of western hardwoods.

Because projected sawtimber growth under lower timber demand is less than needed timber removal after 1975 (table 61 and fig. 46), the level at which timber removal and growth can be sustained in balance is necessarily below the timber removal required to meet the lower level demand. In terms of all species, the sawtimber removal that could be sustained in 2000 is 9 percent below the timber removal needed to sustain lower timber demand. In terms of softwoods, sustained timber removal is 16 percent below that needed to meet lower timber demands in 2000.

These projections suggest that if sawtimber removal and growth were kept in balance after 1975 there would result a 9-percent decline in per capita consumption of sawtimber in relation to lower demand levels, or a 15-percent decline in per capita consumption in relation to 1952 timber cut. A choice thus becomes evident here: If the American people continue to accelerate forestry as they have in recent years, are willing to drastically revise their timber consumption habits from softwoods to hardwoods, and are willing to get along with 15 percent less sawtimber per person than they are now doing, the United States can maintain a balance between timber removal and growth after 1975.



Sustained timber removal as shown by the solid line above brings timber removal and projected growth of both softwoods and hardwoods into balance by 1985. The increased use of hardwoods needed to attain this balance exceeds any trends now in sight. Reduced removal of softwoods needed to reach a balance falls below the removal necessary to supply lower projected demands for softwoods. Moreover, sustained timber removal for all species combined falls below the total removal needed to supply lower projected demands.

Figure 48

Quality Outlook

To appraise the quality outlook, both the need for quality timber and prospective supplies of such timber should be considered. The continued need for quality wood is largely a matter of judgment. One reason for this is that there is no single standard of quality. Different products require different wood qualities, and quality means different things to different persons. Substantial recognition must be given to the very considerable technological progress that has been made to overcome poor quality of wood as a raw material. There will continue to be much technological progress in this direction.

Some quantitative indication can be developed of continued need for quality wood by comparing projected demand for millwork, siding, furniture, and veneer and plywood to 1952 consumption for these items. Such products are largely, although not entirely, manufactured from high-quality logs. The medium level projected demand for these items in 1975 and 2000 is 65 and 143 percent greater respectively than 1952 consumption. Thus, by 2000 there is a projected demand for these items needing substantial portions of high-quality material of nearly 2½ times that of 1952. Even if a lower proportion of these items requires high-quality material in the future than in the past, there will still be a very substantial demand for quality logs.

Tree size reflects quality in a general way and thus sawtimber is a general indication of quality. In 1952, 84 percent of the timber cut came from sawtimber trees. Although some allowance was made for a shift from sawtimber to poletimber in projecting timber demand, it is estimated that 80 percent of timber demands by 2000 will still require sawtimber-size trees. These two indications suggest that, despite past and prospective technological progress to overcome poor quality, future demand for quality logs, although possibly less in relation to total demand than in the past, will probably be substantially greater in absolute terms.

Quantitative information on the inventory of good quality trees is sketchy, but the trend in the supply of good quality standing timber appears to be downward. Indications of this include:

(1) Repeat surveys covering about one-third of all commercial forest land in the East show that greater proportions of sawtimber volumes are occurring in the smaller trees than formerly. The reason is that timber cut is concentrating on the bigger trees—this in turn is another evidence of the need for quality material.

(2) Current eastern inventories show that high proportions of timber volume are in trees of small size and poor in log grade. If allowed to grow, many of these small trees, of course, will increase in size and improve in quality.

(3) Timber species preferred because of certain special properties are being gradually replaced by less useful species.

(4) There is a very large volume of cull trees in eastern hardwoods.

(5) The excess of sawtimber removal over projected growth for eastern softwoods suggests declining trends in the inventory of quality material. The same situation with respect to western species also suggests declines in the quality of western timber. The latter, of course, is to be expected as the old-growth sawtimber of the West, which is the largest reservoir of high-quality timber in the Nation, is gradually harvested.

All in all, the outlook for quality appears to be (a) a continuing need for quality timber which is perhaps less relatively than in the past but more in terms of total demand; and (b) a declining trend in the supply of quality timber if projected demands are met and forestry accelerates no faster than indicated by recent trends. These two indications suggest that meeting the demand for quality timber may be more difficult in the future than in the past despite technological progress.

Projected Inventory Would Not Conform to Needs

The inventory that could be expected if timber demands are met each year and if forestry assumptions previously described prevail are summarized in table 60. The contrast between projected and needed sawtimber inventories show that projected inventory would be greater than needed for eastern hardwoods and for western species in 1975 under both the lower and medium timber demand (table 62); but projected inventories would be less than needed for eastern softwoods in 1975 at both demand levels. The same situation would continue to 2000 if lower timber demands were met, but if medium demands were met the inventory of all three species groups would theoretically be deficient by that time.

The most significant conclusions to be drawn from comparisons of projected and needed inventories are (a) sawtimber inventories of eastern softwoods will not build up as rapidly as needed, and (b) the conversion of western old growth to more productive young forests and a better distribution of age classes will not have been accomplished rapidly enough to achieve the needed growth of western species by 2000.

As in the projections of growth, the estimates of future sawtimber inventories which show such large deficiencies in relation to needed inventories in 2000 at the medium level of timber demand should be considered to be suggestive only. The same qualifications with respect to these large discrepancies that were explained in the discussion of projected growth apply equally well to projections in inventory.

TABLE 62.—*Relation of projected sawtimber inventory to needed inventory, 1975 and 2000*

Species group	Change in projected inventory from needed inventory			
	1975		2000	
	Lower projected demand	Medium projected demand	Lower projected demand	Medium projected demand
	Percent	*Percent*	*Percent*	*Percent*
Eastern hardwoods	+51	+3	+46	−52
Eastern softwoods	−31	−54	−36	(1)
Western species	+99	+66	+12	−43
All species	+45	+7	+6	−65

[1] Under the assumptions, projected inventory would be negligible (table 60); thus the theoretical percentage change from needed inventory would approach a minus 100 percent.

THE OUTLOOK IN BRIEF

From the preceding summary of the outlook for timber supply certain generalized deductions can be drawn. First, however, it is necessary to recall the assumptions on which most of the discussions were based, namely, (a) timber removal would climb steadily and timber demands would be met each year, and (b) forestry would continue to intensify and accelerate as indicated by recent trends. The deductions which appear justified are:

1. There is sufficient standing timber, plus what will be grown, to supply either medium or lower timber demands each year until 2000. This cannot be done, however, without serious adverse impacts on timber inventories and growth.
2. There is no timber famine in the offing but some shortages may be expected, especially of softwood sawtimber of the preferred species and grades, and especially after 1975. There is no danger of timber becoming a surplus crop.
3. Prompt and very substantial expansion and intensification of forestry in the United States is necessary if timber shortages are to be avoided by 2000. This is due to increases in future timber demands over present consumption largely because of expected expansion of the population rather than increases in per capita demand. The necessary intensification in forestry will have to be in addition to what could be expected by extending the trends in forestry improvements of recent years. This acceleration in forestry will have to come soon, and very largely within the next two decades, because otherwise it will be too late for the effects to be felt by 2000. The degree of forestry intensification needed is much larger and far greater than the general public or most experts are believed to have visualized.
4. If there is a 15-percent reduction in sawtimber consumption per capita and if there could be a drastic switch in the consumption pattern from softwoods to hardwoods, timber removal and growth could be kept in balance after 1975 even if there is no intensification of forestry beyond recent trends.
5. The American people may find themselves getting along with somewhat less timber than would be needed to meet medium projected timber demand, and there may be a rise in the price of timber products in relation to competing materials.
6. The effects, if they occur, of not meeting timber demand, of growth deficiencies, of shortages in some softwood species, sizes, and grades, and rises in relative price probably will not be felt very much until after 1975.
7. Much progress has been made in forestry in recent years. The undesirable effects of not meeting timber demand and of rising prices need not occur if the American people achieve within the next few years a degree of forestry on all commercial forest land roughly equivalent to that which is practiced today on the better managed lands.

Forestry is not a short-time proposition. Where this Nation stands in timber supply in the year 2000 will depend largely on actions taken during the next two decades. Recent encouraging forestry trends must continue. But this is not enough. Acceleration of these trends is vital, and to a degree that will startle many of us. There are no grounds for complacency. If the timber resources of the Nation are to be reasonably abundant at the end of the century and if our children and their children are to enjoy the same timber abundance that we ourselves know, standards and sights must be raised. The potential of the land is adequate. The opportunity is there.

TWENTY-TWO HIGHLIGHTS

1. *Continued expansion of the Nation's economy* is *expected.*

Any appraisal of future supply and demand for natural resources involves a choice between such basic assumptions as prosperity or depression, population growth or decline, rising or falling standards of living, and peace or war. The Timber Resource Review is geared to a continued rapid rise in population, economic prosperity and higher living standards as reflected in a continued rise in gross national product, and expectations of peace but continued military preparedness.

The most fundamental assumption is that popu-

lation of the United States will be 215 million in 1975, and 275 or 360 million in 2000, as contrasted to an estimated 157 million in 1952. These are increases of 75 and 130 percent for 2000 above 1952 population. The 275 million population estimate for 2000 is essentially conservative, reflects a rate of increase slightly less than prevailed during the first half of the century, and is below the midpoint of projections of Census Bureau estimates. It was used in projecting lower and medium timber demand. The 360 million population is a top-level estimate used only in projecting upper timber demand.

Gross national product, which is the total national output of all goods and services, is estimated to increase from $354 billion in 1952 to $630 billion in 1975 and $1,200 or $1,450 billion in 2000. Although these would be large increases of 240 and 310 percent from 1952 to 2000, the former results from a somewhat lower rate of increase than occurred in the 45-year period 1910–55. As in population projections, the higher estimate of gross national product for 2000 was used only in developing upper timber demand.

2. *Potential demand for timber products is strikingly upward.*

Timber products consumption, both past and present, furnishes some indication as to future demands. Lumber still makes up well over half of all industrial wood consumed although the long-time trend in lumber's share of the total has been downward. Per capita lumber consumption has decreased more than 50 percent since 1900; but total lumber consumption has held up and even increased substantially since the 1930's.

Both total and per capita consumption of pulpwood has increased rapidly. Since 1920, per capita consumption of pulpwood has tripled and total consumption has increased 5 times. Pulpwood now constitutes over one-fourth of all industrial wood consumed, whereas in the early 1900's it made up only 2 percent.

Wood is not losing out in the market place. Since 1935 both total and per capita consumption of industrial wood have increased. Industrial wood consumption was at an all-time high in 1952 and per capita consumption was up to the 1929 level.

Three projections of timber demand were developed. Lower and medium projections were prepared for both 1975 and 2000; an upper projection was prepared only for 2000. Medium timber demand is considered the basic projection. It is based on specified assumptions as to population, gross national product, and price, and lower and upper projected timber demand are variants from it. Lower timber demand is based on the same assumptions as is the medium projection with respect to population and gross national product, but assumes that future prices of timber products will rise substantially faster than prices of competing materials. The upper projection is the same as the medium in assuming that future prices of timber products will parallel the price trends of competing materials, but differs from the medium projection in assuming higher population and gross national product. Medium projected timber demand offers a desirable objective from the viewpoint of public policy.

Medium projected demand of all timber products indicates increases over 1952 consumption of 32 and 83 percent for 1975 and 2000, respectively. In actual amounts the consumption of 12.3 billion cubic feet in 1952 would rise to an estimated 16.2 in 1975 and 22.4 billion cubic feet in 2000. The two principal components of timber demand, lumber and pulpwood, would by 2000 show increases of 90 and 182 percent over 1952.

Although these are large increases, they appear quite conservative when expressed on a per capita basis. Projected per capita demand of all timber products taken together would be less than 1952 consumption for each of the three levels of projected demand and in both 1975 and 2000, with the single exception of the medium projected demand in 2000 when there would be a 4-percent increase in per capita consumption. In other words, if each person consumed the same amount of wood in 2000 as occurred in 1952, consumption would exceed both the lower and upper timber demands and would closely approach the medium projection.

For lumber, the per capita relationships of projected demand to 1952 consumption are the same as for all timber products; but projected pulpwood demand indicates per capita increases at all levels and in both 1975 and 2000.

The large upswing in total timber demands over 1952 is attributable very largely to expected growth in the population rather than to increases in per capita demand.

3. *The United States must continue to rely chiefly on domestic timber resources.*

The United States, including all of Alaska, controls 8 percent of the forested area of the world and 15 percent of the timber under exploitation. Although the area is less than that of some nations, the timber volume is greater than that of most. Canada, for example, has more forest area but less timber than the United States, including Alaska. There are about 4 acres of forest land per capita in the United States, about 8 acres per capita in the U. S. S. R., and about 66 acres per capita in Canada.

In terms of the softwood timber resource, the United States has about 14 percent of the world's area and 20 percent of the timber volume. Although Canada has a greater softwood area, it has about half as much softwood volume as the United States. More than half of the world's

softwood forest area and timber volume belongs to the Soviet Bloc of nations.

Although the United States relies chiefly on its domestic timber resources, it is nevertheless a net importer of timber products. About 10 percent of United States consumption is imported from Canada chiefly in the form of pulpwood, woodpulp, and paper, and this comprises 90 to 95 percent of all United States imports. The extent of the Canadian timber resource, the Canadian potential for increased forest growth, the outlook for expansion of the domestic economy of Canada, and the other demands upon Canada for export of her forest products, all point to some increase in exports to the United States, but in amounts insufficient to contribute materially toward satisfying increased demands in the United States.

4. *The Nation has no surplus of commercial forest land.*

Earlier appraisals of the timber situation have concluded that there is ample forest land to grow needed timber crops in the United States, if the land is effectively used. This is no longer clearly apparent. The long-time trend in the Nation's forest land has been distinctly downward as land has been cleared for agriculture, as highways have been built, and as towns have sprung up and urban areas expanded. There has been no great net change in the area of commercial forest land in recent decades. Despite a small net increase since 1945, in all probability the long-term downward trend will continue because of expected increases in population, further urbanization, continued highway, power, and reservoir developments, priority use for recreation and water yield, and expansion of agriculture. Considering this trend in land use in the light of projected timber demands, and the impracticability of every acre of forest land producing to capacity, it is no longer a clear-cut conclusion that there is ample forest land. On the contrary, further significant reductions in the acreage of land devoted to growing trees should be avoided in general or should be made with full realization that such withdrawals may adversely affect future timber supplies.

5. *One-fourth of the forest land is poorly stocked or nonstocked.*

There are 114 million acres of commercial forest land in the United States that are less than 40 percent stocked with trees. This is about one-fourth of the total commercial forest area, and it includes nearly 42 million acres that are less than 10 percent stocked. Thus, one-fourth of the forest land is not now growing, and will not grow, timber to anywhere near the productive capacity of the land unless stocking is greatly improved. Moreover, there is an additional 125 million acres which are 40 to 70 percent stocked. These facts mean that the Nation is not making effective use of the land now devoted to forest production.

6. *Three-fourths of the forest land is in the East, but two-thirds of the sawtimber volume is in the West.*

The great bulk of the commercial forest land and timber growing capacity is in the more heavily populated and industrialized eastern half of the country, with three regions—the Southeast, Lake States, and West Gulf—having 40 percent of the national total. On the other hand, the West, including Coastal Alaska, with only one-fourth of the commercial forest area, has 70 percent of the sawtimber volume. This is due mainly to heavy stands on the 50 million acres of remaining western old-growth sawtimber. Three States—Oregon, California, and Washington—have about half of the Nation's sawtimber.

This great difference in the geographical distribution of commercial forest land and productive capacity in contrast to that of standing sawtimber means that in time there will be a significant shift from West to East in relative timber cut and industrial capacity. Projected timber demand and growth capacity are such, however, that despite a relative decline, the West can and should ultimately grow and harvest more than its 1952 timber cut.

7. *Total timber volumes are about the same as in 1945.*

Direct comparisons of timber volumes between those reported by the Timber Resource Review and by the appraisal of the timber situation conducted by the Forest Service in 1945 are not possible. In order to be compared, standing timber volumes need to be adjusted to the same standards.

The 1953 sawtimber volume of 1,968 billion board-feet (excluding Coastal Alaska) is not significantly different from the adjusted 1945 volume. Sawtimber comparisons show little change in eastern softwoods; but eastern hardwoods apparently increased 9 percent, and western species declined 5 percent. The 1953 volume of growing stock of 498 billion cubic feet likewise is about the same as adjusted 1945 volume. The most significant features of these comparisons are the increase in eastern hardwoods and the status quo in eastern softwoods. The latter should be substantially increasing if projected timber demands are to be met.

8. *Heavy reliance is placed on a small group of species.*

Douglas-fir and ponderosa pine account for 37 percent of the live sawtimber volume; southern yellow pines and the oaks for 45 percent of the sawtimber growth; and Douglas-fir and southern yellow pines for 48 percent of the cut. Thus, it is evident that heavy reliance is placed on a small group of species although they vary in importance depending upon whether volume, growth, or cut is the criterion.

Western true firs and western hemlock are important in terms of sawtimber volume, accounting for about 17 percent of the national total, but were relatively unimportant in 1952 in terms of either growth or cut.

9. *Timber quality is declining.*

There is substantial evidence that standing timber is declining in quality: 10 percent of sound timber volume is in cull trees; the volume of cull hardwoods in the East is equivalent to one-fourth of eastern hardwood growing stock; two-thirds of eastern hardwood sawtimber would probably classify as poor Grade 3 logs; one-fourth of eastern softwood sawtimber is in the smallest (10 inch) diameter class; preferred species or types are gradually being replaced in many areas; the proportion that larger trees comprise of total timber volumes is decreasing; and rapidly grown second growth is poorer than old growth in texture, grain, dimensional stability, machining, and other characteristics needed for quality uses.

Medium projected demand for millwork, siding, furniture, veneer, and other timber products requiring substantial proportions of high-quality material is estimated in 2000 at two and one-half times 1952 consumption. It is also expected that 80 percent of timber demand in 2000 will require sawtimber size trees.

Despite the very considerable technological advances that offset in part the need for quality, the outlook appears to be for a continuing need, which may be less relatively than in the past, but greater in terms of total demand, and for a declining trend in the supply of quality timber.

10. *Timber growth is increasing.*

One of the most favorable factors in the timber situation is that growth is increasing. On a national basis, sawtimber growth was nearly 9 percent more in 1952 than the adjusted growth in 1944. Eastern softwood sawtimber growth is estimated to be 11 percent greater than in 1944 and hardwoods 16 percent greater. One-half of all sawtimber growth occurs in the South, with nearly one-third of the total on the southern yellow pines.

In the West, sawtimber growth appears to have decreased 3 percent between 1944 and 1952. As old-growth areas in the West are cut and more second-growth stands reach measured size, western growth should substantially increase.

11. *Most eastern species now have favorable growth-cut ratios.*

Overall growth-cut comparisons are misleading because: (1) they conceal the separate and often quite different hardwood and softwood growth-cut ratios; (2) overall comparisons include the growth-cut situation in the West which is distorted by the large amounts of residual old growth; and (3) balances between growth and cut have little meaning unless the inventory is large enough to sustain projected timber demand.

It is significant, however, that eastern softwood sawtimber growth was 20 percent greater than cut in 1952 and eastern hardwood sawtimber growth was 57 percent greater than cut. The favorable softwood growth-cut ratio was brought about as much by a 16-percent reduction in cut as by an 11-percent increase in growth. Most eastern species now have favorable growth-cut sawtimber ratios, although they continue unfavorable for a few preferred species. In the West, the ratio of growth to cut was less than in 1945 because of a decrease in growth and an increase in cut.

12. *One-fourth of timber cut is not utilized.*

Of the timber cut in 1952, one cubic foot out of every four was not utilized. Unused plant residues and logging residues were about equal in volume and totaled nearly 3 billion cubic feet. About one-third of the timber cut for lumber was not used, either for fuel or any other purpose. On the other hand, only 4 percent (excluding chemical losses) of the timber cut for pulp was not utilized. The best utilization was found in the North (82 percent of the cut was used); the West (74 percent used) and the South (72 percent used) show lesser degrees of utilization.

Logging and plant residues can, of course, never be completely eliminated. But reduction of unused residues is one effective way of making available timber supplies go further. About 75 percent of the sawtimber cut is for saw logs, and the proportion of timber cut which is unutilized is higher for saw logs than for any other major product. Improved utilization of the timber cut for saw logs offers the greatest opportunity for supplementing timber supplies.

13. *Destructive agents, principally insects and disease, take extraordinary toll.*

If it were not for the effect of destructive agents, sawtimber growth in 1952, instead of about equaling timber cut, would have nearly doubled it. The "growth impact," which includes not only 1952 mortality but also growth losses from 1952 damage, was about 44 billion board-feet. Insects, disease, weather, fire, and other destructive agents killed nearly 13 billion board-feet of sawtimber in that year, an amount equivalent to one-fourth the net growth. Of this, about 3 billion board-feet was salvaged.

Insects killed seven times as much sawtimber as did fire in 1952 and disease three times as much; mortality was much more severe in the West than in either North or South. In terms of growth impact on sawtimber, disease outranked both insects and fire by more than two to one; growth impact was slightly greater in the South than in other sections.

Fire is a much more serious destructive agent

than statistics indicate. Although fire accounted for only 6 percent of sawtimber mortality in 1952 and 17 percent of growth impact, it is a primary causative agent which often prepares the way for attacks by insects and disease. Furthermore, fire was the first of the serious destructive agents aggressively attacked by cooperative efforts of public and private forest landowners. Much progress has been made, but still only 15 percent of the area is adequately protected in the worst fire years.

If protection from fire could continue to be strengthened, and especially if the toll of disease and insects could be similarly lessened by forest management practices and direct control, a large contribution would have been made toward the growth needed to meet potential future demands.

14. *Fifty-two million acres need planting.*

Although planting rates have increased greatly in recent years, and forest plantations in the United States cover about 5 million acres, there is a big job of planting ahead, mainly in the East and mainly on private lands. About 52 million acres, or 11 percent of all commercial forest land in the Nation, need planting if they are to become productive within a reasonable time. This estimate is conservative in that it does not include areas where it is possible to improve stocking by interplanting or where, by planting promptly after cutting without waiting for natural regeneration, it is possible to reduce the time that lands lie idle. If adequately reforested, the area in need of planting might eventually add about 8 billion board-feet annually to timber supplies.

Planting during the next 25 to 30 years is expected to more than double the 1950–52 rate of nearly 400 thousand acres of acceptable plantations annually, so that by 1985 possibly an additional 25 million acres will have been successfully planted. Output of nursery stock will need to be double the 1952 rate.

15. *Forest productivity poorest on small farm and "other" private ownerships, especially in the South.*

There is conclusive evidence that the productivity of recently cut lands is poorest on the farm and "other" private ownerships. The latter means private ownerships, generally small in size, that are not farm and not forest industry. The two groups of forest holdings involve nearly 4.5 million private ownerships and account for 60 percent of the Nation's total commercial forest land. For the country as a whole, about 40 percent of the farm and 50 percent of the "other" private ownerships qualified their recently cut lands for the upper productivity class.

Small private holdings, regardless of kind of ownership, clearly showed poorer productivity than large and medium-sized properties. Geographically, productivity of recently cut lands is considerably lower in the South than in other parts of the country, and the farm and "other" private ownerships also show poorer ratings for the South than for other sections.

Considering location as well as kind and size of ownership, the small private ownerships of the South are conspicuously below the rest of the country in productivity of recently cut lands. These holdings, numbering 1.8 million, are owned mainly by farmers and the miscellaneous group that makes up the "other" private category; and they comprise 128 million acres, or one-fourth of all commercial forest land. Two-thirds of the recently cut lands in the small private ownerships in the South fail to approximate productivity standards reasonably attainable under average current conditions.

16. *Forest productivity best on public and forest industry ownerships.*

In contrast to farm and "other" private ownerships, about three-fourths of the recently cut lands owned by public agencies and the forest industries qualified for the upper productivity class. Such lands are within at least 30 percent of the standard that is being attained currently on the better managed lands. Two-thirds of the land owned by forest industry is in large holdings. There was little difference between public ownerships as a group and forest industries as a group. However, there were appreciable variations between different parts of the country, different forest industries, and different public ownerships. The pulp industry with 84 percent of its recently cut lands qualifying for the upper productivity class exceeded the national forests with 81 percent and the lumber industry with 73 percent.

These findings show that there is little distinction between productivity of recently cut lands in public ownership and those owned by forest industry. The contrast is between public and forest industry ownerships on the one hand, which comprise about 40 percent of the Nation's commercial forest land and have 75 to 80 percent of recently cut lands in the upper productivity class, and the farm and "other" private ownerships on the other hand, which make up 60 percent of the commercial forest land and have about 46 percent of such lands in the upper class.

17. *Inadequate stocking is the most significant factor in reducing productivity of recently cut land.*

If existing stocking were the only criterion of productivity, over half of the land on which cutting has occurred since 1947 would have failed to qualify in the upper productivity class. A considerable portion of this area which was deficient in existing stocking qualified for the upper class because of reasonable prospects of stocking. The fact remains that understocking, both existing and prospective, is the most important cause

of recently cut lands failing to measure up to upper productivity standards.

18. *Improved stocking, control of destructive agents, accelerated planting, and better utilization are the four best possibilities of increasing timber supplies.*

In addition to timber from commercial forest land in the continental United States and Coastal Alaska, there are several possible supplementary sources which need to be placed in proper perspective. In terms of standing timber there are unknown quantities on reserved but productive forest land and on nonforest land. There are also an estimated 180 billion board-feet of sawtimber in Interior Alaska.

On an annual basis there are 2.2 billion board-feet of sawtimber consumed for fuel, some of which could be used for other products. Net imports from Canada might be increased somewhat above the anticipated annual level (1.7 billion cubic feet) assumed in projecting timber demand.

The best possibilities, however, for permanently adding to timber supplies are (1) obtaining improved stocking on the one-fourth of the commercial forest land of the Nation that is poorly stocked or nonstocked, and obtaining prompt and adequate restocking on recently cut lands in order to make them productive; (2) reducing the growth loss from destructive agents of about 31 billion board-feet annually, and utilizing a substantial portion of the unsalvaged mortality loss which was almost 10 billion board-feet in 1952; (3) capturing the 8 billion board-feet of annual sawtimber growth potential from the 52 million acres of commercial forest land that need planting; and (4) utilizing significant portions of the 37 billion board-feet of salvageable dead trees, the 56 billion board-feet of sound volume in cull trees, and the 2.7 billion cubic feet of residues unused annually, including 2.7 billion board-feet of logging residues.

19. *The key to adequate timber supplies in the future lies with the 4.5 million farm and "other" private holdings.*

The greatest advancements in forestry, the best productivity on recently cut lands, and 70 to 80 percent of the Nation's inventory of softwood sawtimber occur on forest industry and public land. The 23,000 forest industry ownerships account for 13 percent of the commercial forest land; public lands, 27 percent. The national forests contain 45 percent of the softwood sawtimber.

In contrast, the farm and "other" private ownerships have the poorest productivity, own 60 percent of the commercial forest land, are largest in number of owners and potentially the largest in total timber volumes. Eighty-six percent of these 4.5 million ownerships are in forest holdings of less than 100 acres, and 50 percent have holdings of less than 30 acres.

Growth must be increased on industrial and public lands; but unquestionably the key to adequate future timber supplies lies mainly with the 3.4 million farm owners and the miscellaneous group of 1.1 million "other" private ownerships. Although they own mainly very small tracts of forest land, and their principal interests usually are not timber growing, in the aggregate they control well over half of the Nation's commercial timberland and they must continue to supply a substantial portion of the raw materials for forest industry. Industrial and public ownerships alone do not have the capacity to sustain future timber demands.

20. *Growth needed to sustain future timber demands is much greater than 1952 growth.*

Comparisons of current levels of growth and inventory with amounts that may be needed in the future help to indicate how easy or difficult it may be to sustain projected timber demands.

Needed growth of sawtimber in 2000 to sustain projected medium timber demand is 105 billion board-feet. This is close to the growth of 101 billion board-feet which might be realized if all commercial forest land were, on the average, managed as well as the better managed lands today. Both are a little more than twice the 1952 growth.

Percentagewise, sawtimber growth needed to sustain medium demands is 44 and 122 percent above 1952 growth for 1975 and 2000, respectively. On a per capita basis, needed growth is 5 and 27 percent above 1952 growth. In other words, to sustain medium timber demands would mean growing about a fourth more sawtimber per person in 2000 than was grown in 1952.

To sustain lower timber demands would mean growing 24 and 67 percent more sawtimber in 1975 and 2000 than in 1952; but this would be equivalent to per capita decreases of 9 and 4 percent in sawtimber growth.

For all three species groups—eastern hardwoods, eastern softwoods, and western species—sawtimber growth by 2000 would need to increase very substantially above 1952 levels if medium timber demands are to be sustained.

Inventory adjustments are also indicated if there is to be available the sawtimber growth needed to sustain either lower or medium timber demands. To sustain medium demand, the sawtimber inventory of eastern hardwoods needs to double by 2000, whereas a fourfold increase is needed in eastern softwoods. Better distribution of age classes and orderly harvesting of old growth could result in a 26-percent reduction in sawtimber inventory of western species by 2000 and still sustain the western share of medium timber demand.

21. *Projected growth is far short of needs.*

Comparisons of the growth and inventory that may be expected with the growth and inventory that may be needed is of much greater significance than comparing needs with 1952 levels. Projected growth and inventory are the amounts that may be expected in 1975 and 2000 under the assumptions that (a) timber removals increase steadily each year to meet rising demands, and (b) forestry continues to intensify and expand at a rate indicated by recent trends so that by 1975 and 2000 it will be considerably more widespread and intensive than in 1952.

If medium timber demands are met each year, projected sawtimber growth in relation to needed growth would show a deficit of 14 percent by 1975 and 76 percent by 2000. If lower instead of medium demands are met, there would be a slight surplus of sawtimber growth in 1975 but a 16-percent deficit by 2000.

Eastern softwoods and western species would have either substantial or very large sawtimber growth deficits under both lower and medium levels of timber demand in both 1975 and 2000. Eastern hardwoods would show a sawtimber growth surplus beyond 1975, but would fall short of needed growth under the medium timber demand by 2000.

The very large growth deficits are suggestive only and are believed unlikely to occur to the extent indicated. At some point growth would become so low in relation to needs that prices would rise, timber removal would be less than assumed, forestry would intensify faster than assumed, growth would increase, and the actual deficit would be less than indicated. The projections, nevertheless, have real value because they show that neither lower nor medium timber demands can be sustained if forestry is intensified no faster than anticipated from recent trends.

If sawtimber growth and removal are kept in balance after 1975, under assumptions of continuing recent trends in forestry and by a drastic consumption switch from softwoods to hardwoods, the level of balance that can be sustained by 2000 is 9 percent below the lower projected timber demand. This also would mean a 15-percent reduction in per capita consumption below 1952.

If either lower or medium timber demands are met yearly and forestry progresses no faster than recent trends indicate, sawtimber inventories of eastern softwoods will not build up as rapidly as needed, and the conversion of western old growth to more productive young forests and a better distribution of age classes will not have been accomplished rapidly enough to achieve the needed growth of western species by 2000.

22. *The overall outlook.*

(1) The Nation's need for timber to supply demands of a growing population will be strikingly greater than today or at any time in the past. If per capita use of timber products increases only 4 percent by 2000 as indicated by medium projections of demand, total wood consumption will be 83 percent greater than in 1952, primarily because of an estimated 75-percent increase in population. There is the potential to meet that need if forestry knowledge and skills are applied promptly and with utmost vigor and determination.

(2) There is sufficient standing timber, plus what will be grown, to supply either medium or lower timber demands each year until 2000. This cannot be done, however, without serious adverse impacts on timber inventories and growth unless there are much more rapid advancements in forestry than indicated by recent trends.

(3) There is no timber famine in the offing, but some shortages can be expected, especially of softwood sawtimber of the preferred species and grades, and especially after 1975. There is no danger of timber becoming a surplus crop.

(4) Prompt and very substantial expansion and intensification of forestry in the United States is necessary if timber shortages are to be avoided by 2000. This is due to increases in future timber demands over present consumption—largely because of expected expansion of the population rather than increases in per capita demand. The necessary intensification in forestry will have to be in addition to what could be expected by extending the trends in forestry improvements of recent years. This acceleration in forestry will have to come soon, and very largely within the next two decades, because otherwise it will be too late for the effects to be felt by 2000. The degree of forestry intensification needed is much larger and far greater than the general public or most experts are believed to have visualized.

(5) If there is a 15-percent reduction in sawtimber consumption per capita and if there could be a drastic switch in the consumption pattern from softwoods to hardwoods, timber removal and growth could be kept in balance after 1975 even if there is no intensification of forestry beyond recent trends.

(6) The American people may find themselves getting along with somewhat less timber than would be needed to meet medium projected timber demand, and there may be a rise in the price of timber products in relation to competing materials.

(7) The effects, if they occur, of not meeting timber demand, of growth deficiencies, of shortages

in some softwood species, sizes, and grades, and rises in relative price probably will not be felt very much until after 1975.

(8) Much progress has been made in forestry in recent years. The undesirable effects of not meeting timber demand and of rising prices need not occur if the American people achieve within the next few years a degree of forestry on all commercial forest land roughly equivalent to that which is practiced today on the better managed lands.

Forestry is not a short-time proposition. Where this Nation stands in timber supply in the year 2000 will depend largely on actions taken during the next two decades. Recent encouraging forestry trends must continue. But this is not enough. Acceleration of these trends is vital, and to a degree that will startle many of us. There are no grounds for complacency. If the timber resources of the Nation are to be reasonably abundant at the end of the century and if our children and their children are to enjoy the same timber abundance that we ourselves know, standards and sights must be raised. The potential of the land is adequate. The opportunity is there.

Forest Land and Timber

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FOREST LAND AND TIMBER

John R. McGuire
M. B. Dickerman

The present status of forest land and the present volume of timber on it are major considerations in reviewing the Nation's timber resources. With more accurate and comprehensive information being assembled about the condition and extent of forest land and the volume, kind, and quality of timber, it is now possible to form a clearer picture than heretofore of the domestic timber supply. To show the major relationships involved, this chapter describes our forest land and timber resources. The text is keyed chiefly to regional data.[20]

FOREST LAND

Of the nearly 2 billion acres of land in the United States and Coastal Alaska, 34 percent, or 664 million acres, are classified as forest land (fig. 49). This is the land which Americans and even others must look to for a future supply of forest products. How it is used, where it is located, who owns it, and what its capacity is to produce, are all considerations bearing heavily on the welfare and security of the Nation.

The forest area is far from homogeneous. There are concentrations of softwood (coniferous) forests in the West, but these are often broken up by agricultural valley lands or by wide stretches of grazing land. West of the Cascade Range in Washington and Oregon there are extensive areas of Douglas-fir. Redwood, Douglas-fir, and mixed conifers predominate in California. East of these coastal forests, ponderosa pine forests are most prevalent, but white pine and larch are common in the Northern Rockies, and lodgepole pine forests

[20] More detailed statistics and a discussion of the adequacy of the estimates appear in the appendix.

⅓ of land area is forest

	UNITED STATES	COASTAL ALASKA	TOTAL
	in thousands of acres		
FOREST LAND	647,686	16,508	664,194
commercial	484,340	4,269	488,609
noncommercial	163,346	12,239	175,585
CROPLAND	411,148	3	411,151
PASTURE & RANGE	693,246	91	693,337
OTHER	151,744	18,917	170,661
TOTAL LAND AREA	1,903,824	35,519	1,939,343

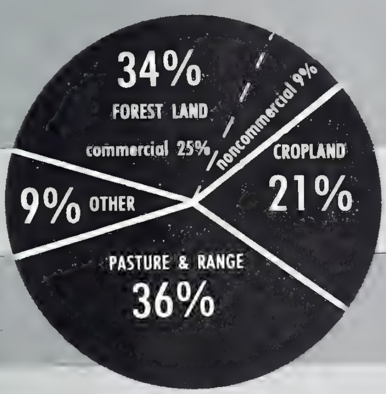

Figure 49

and stands of fir and spruce are widely distributed, mainly at higher elevations. Midcontinent in the Plains States there are river-bottom stringers of hardwoods and the pine forests of the Black Hills.

In the North and South, the softwood and hardwood forests are intermingled and, almost everywhere, are interspersed with farms and other nonforest lands. A wide band of oak-hickory forest stretches from southern New England to Missouri and Oklahoma, separating the pine forests of the South from the maple-birch-beech, spruce-fir, and other types of the North.

Alaska has dense coniferous forests in a narrow coastal belt along the southeastern panhandle. Less dense coniferous and birch forests extend far into the interior.

Generally, two classes of forest land are recognized, commercial and noncommercial. This report is concerned primarily with the commercial lands, for from them must come most of the timber for our future requirements. The noncommercial lands are those which have only limited possibilities for timber production or are reserved. There is also a substantial area in small and scattered forest tracts on land classed as nonforest.

Usually only the commercial lands are taken into account in appraising the timber resource. As of the beginning of 1953, about three-fourths of the 664 million acres of forest land were classified as commercial and one-fourth as noncommercial (table 63).

Distribution of Forest Areas and Types

Commercial Forest Land

Three-fourths of the Commercial Forest Land Is in the East

The total area of commercial forest land in the United States is nearly 485 million acres, and Coastal Alaska has an additional 4 million acres. Distribution of the commercial area varies by forest regions (fig. 50). The 8 eastern forest regions have three-fourths of it, and the 4 western regions have one-fourth. Three eastern regions, the Southeast, Lake States, and West Gulf, each have over 50 million acres and collectively include 41 percent of all the commercial forest land in the United States. Regions having the least commercial forest land are the Plains, California, and the Southern Rocky Mountain, each with less than 25 million acres.

Some forest regions have a much higher percentage of commercial forest land than others (fig. 51). For example, in New England 76 percent of the total land area is classed as commercial forest, whereas the average for the United States and Coastal Alaska is 25 percent. Falling considerably below the national average are California, the Northern and Southern Rocky Mountain Regions, Coastal Alaska, and the Plains.

Hardwood and Softwood Types About Equal in Area

The occurrence and distribution of species associations (forest cover types) are a useful guide as to what to expect in the future timber crop. On the 489 million acres of commercial forest land, 20 major forest type groups are recognized, 10 in the East and 10 in the West. The eastern hardwood types occupy 51 percent of the total acreage. The remainder, except for a relatively small acreage of western hardwood, supports softwood forest types—in area divided almost equally between the East and the West, including Coastal Alaska (fig. 52).

The most extensive eastern softwood type group is the loblolly-shortleaf pine type group,[21] which accounts for half of the eastern softwood acreage (table 64). Nearly one-fourth of the area is occupied by the longleaf pine-slash pine type group—most of it in the Southeast—upon which the important naval stores industry is based. Together these two pine type groups, occupying some 40 percent of the South's commercial forest land, comprise the major softwood timber-producing area in the East.

The other eastern softwood type groups, spruce-fir and white-red-jack pine, occur mainly in the northern Lake States and in northern New England. Spruce-fir forests have always been a mainstay of the pulp industry. White-red-jack pine occurs today only as remnants of a once extensive forest. The white pine stands of the Lake States and the Northeast are still of some importance in local areas, but they played their chief role many years ago.

Oak-Hickory Most Widespread Type in East

Eastern hardwood types have some highly valuable species, but they are frequently characterized by low quality. Oak-hickory, most widespread of all eastern type groups, occupies nearly half of the eastern hardwood area and is represented by a large number of species and types growing on a wide variety of sites. For many years, oak-hickory has presented a problem because of poor quality. "Scrub oak" has become a common local name for a sizable part of the acreage in this type group.

The highly valuable maple-beech-birch type group of the Northeast and, to a lesser extent, the Lake States, occupies about one-fifth of the commercial forest land in the North. Sugar maple and yellow birch are its most important species.

[21] In all type groups, the species for which the group is named are generally most abundant, but they may be scarce or absent in some parts of the type-group area. In New Jersey, New York, and Massachusetts, for example, pitch pine is the chief representative of the loblolly-shortleaf pine type group. In the northern Appalachians, Virginia pine is common and loblolly pine may be entirely absent. In the western white pine type group in California, sugar pine is the major species.

TABLE 63.—*Forest land area of the United States and Coastal Alaska, by section, region, and State, January 1, 1953*

Section, region, and State	Total	Commercial	Noncommercial
	Thousand acres	*Thousand acres*	*Thousand acres*
North:			
New England:			
Connecticut	1, 990	1, 973	17
Maine	17, 088	16, 601	487
Massachusetts	3, 288	3, 259	29
New Hampshire	4, 848	4, 682	166
Rhode Island	434	430	4
Vermont	3, 730	3, 713	17
Total	31, 378	30, 658	720
Middle Atlantic:			
Delaware	454	448	6
Maryland	2, 920	2, 897	23
New Jersey	1, 958	1, 910	48
New York	14, 450	12, 002	2, 448
Pennsylvania	15, 205	15, 108	97
West Virginia	9, 907	9, 860	47
Total	44, 894	42, 225	2, 669
Lake States:			
Michigan	19, 322	18, 849	473
Minnesota	19, 344	18, 098	1, 246
Wisconsin	16, 535	16, 325	210
Total	55, 201	53, 272	1, 929
Central:			
Illinois	3, 993	3, 938	55
Indiana	4, 103	4, 045	58
Iowa	2, 510	2, 505	5
Kentucky	11, 497	11, 446	51
Missouri	15, 177	15, 064	113
Ohio	5, 446	5, 396	50
Total	42, 726	42, 394	332
Plains:			
Kansas	1, 668	1, 664	4
Nebraska	1, 482	1, 480	2
North Dakota	433	414	19
Oklahoma (west)	4, 302	650	3, 652
South Dakota (east)	776	684	92
Texas (west)	26, 000	600	25, 400
Total	34, 661	5, 492	29, 169
Total, North	208, 860	174, 041	34, 819
South:			
South Atlantic:			
North Carolina	19, 513	18, 976	537
South Carolina	11, 943	11, 891	52
Virginia	15, 832	15, 285	547
Total	47, 288	46, 152	1, 136
Southeast:			
Alabama	20, 771	20, 756	15
Florida	23, 047	21, 519	1, 528
Georgia	24, 057	23, 969	88
Mississippi	16, 473	16, 440	33
Tennessee	12, 558	12, 301	257
Total	96, 906	94, 985	1, 921
West Gulf:			
Arkansas	19, 346	19, 292	54
Louisiana	15, 990	15, 899	91
Oklahoma (east)	6, 027	5, 257	770
Texas (east)	11, 708	11, 703	5
Total	53, 071	52, 151	920
Total, South	197, 265	193, 288	3, 977

TABLE 63.—*Forest land area of the United States and Coastal Alaska, by section, region, and State, January 1, 1953*—Continued

Section, region, and State	Total	Commercial	Noncommercial
	Thousand acres	*Thousand acres*	*Thousand acres*
West:			
Pacific Northwest:			
Douglas-fir subregion	29, 047	25, 455	3, 592
Pine subregion	25, 082	19, 910	5, 172
Total	54, 129	45, 365	8, 764
Oregon	30, 261	25, 875	4, 386
Washington	23, 868	19, 490	4, 378
Total	54, 129	45, 365	8, 764
California	42, 541	17, 317	25, 224
Northern Rocky Mountain:			
Idaho	21, 025	13, 372	7, 653
Montana	22, 330	15, 727	6, 603
South Dakota (west)	1, 393	1, 266	127
Wyoming	10, 513	3, 475	7, 038
Total	55, 261	33, 840	21, 421
Southern Rocky Mountain:			
Arizona	19, 212	3, 180	16, 032
Colorado	20, 834	8, 451	12, 383
Nevada	12, 036	109	11, 927
New Mexico	21, 329	5, 735	15, 594
Utah	16, 219	3, 014	13, 205
Total	89, 630	20, 489	69, 141
Total, West	241, 561	117, 011	124, 550
United States	647, 686	484, 340	163, 346
Coastal Alaska	16, 508	4, 269	12, 239
All regions	664, 194	488, 609	175, 585

Swamp and bottom-land forests of the oak-gum-cypress and elm-ash-cottonwood type groups cover about one-fourth of the eastern hardwood area. There are large areas of the former in the lower Mississippi Valley and along streams in the southern Coastal Plain. The remainder of the eastern hardwood area supports types belonging to the oak-pine and aspen-birch groups. The oak-pine type group occupies areas along the fringes of the oak-hickory belt or scattered through the southern pine region. The aspen-birch types are pioneer types that have invaded large areas of cutover pine land in the North.

Most Extensive Western Types Are Ponderosa Pine and Douglas-Fir

In the West, from an area standpoint, the most important type group is ponderosa pine. It covers about one-third of the commercial forest land (table 65). In the more arid sections, open forests of ponderosa are typical; dense stands are characteristic where rainfall is more plentiful. Ponderosa pine not only occupies a large acreage in the pine subregion of the Pacific Northwest,

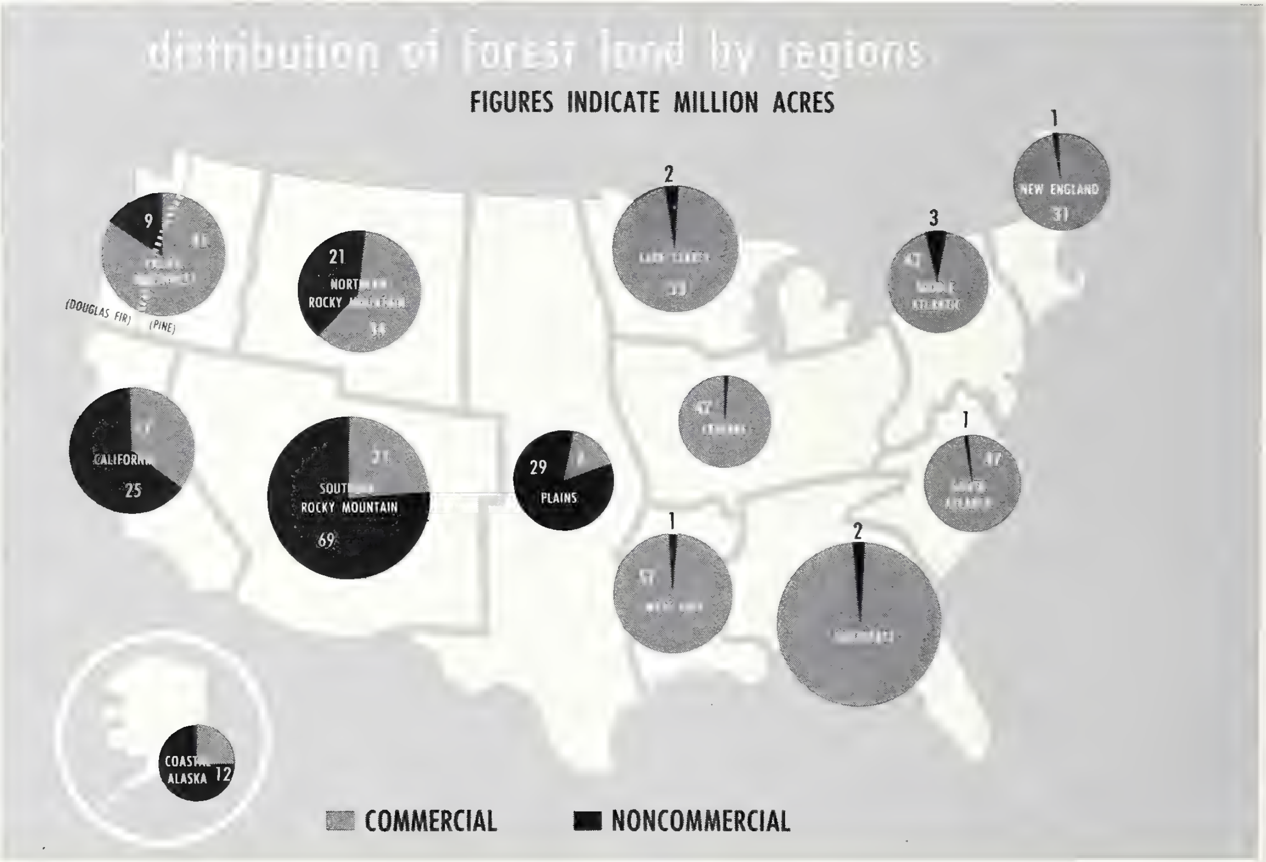

Figure 50

but it is also the most extensive commercial forest type in California and in the Southern Rocky Mountain Region.

About one-fourth of the western commercial forest land carries stands in which Douglas-fir predominates. Most of the Douglas-fir area is in the Pacific Northwest, but the type group is also widespread in the Northern Rocky Mountain Region and in California.

While none of the other eight western type groups approach ponderosa pine or Douglas-fir in acreage, several are significant in relation to timber supply. The western white pine and redwood groups are noted because of the high quality and specialty uses of their predominant species. Larch types, though of lesser importance nationally, are a major source of poles and saw logs in the Northern Rocky Mountain Region.

The hemlock-Sitka spruce type group accounts for nearly all of the commercial forest land in Coastal Alaska and is the characteristic type along the coast in Washington and Oregon. In both regions, the pulp and lumber industries look to it for wood supplies.

The lodgepole pine types and the fir-spruce types are widely distributed, particularly in the Rocky Mountain Region. For the present, at least, the water values of both of these type groups far exceed their timber values.

The commercial forest area of the other western softwood type group, pinyon pine-juniper, is minor. The group is classed as commercial only in the Northern Rocky Mountain Region, where its stands contain some ponderosa pine; elsewhere it is noncommercial. Western hardwood types occupy only three percent of the commercial forest land in the West and less than one percent of the commercial forest land in Coastal Alaska. They are of very little importance in the timber economy.

Noncommercial Forest Land

One-fourth of the forest land area is classified as noncommercial. Included are 161 million acres of unproductive forest land and 14 million acres of productive forest land that is reserved from timber use (table 66). About 12 million of the unproductive acres are also reserved for special uses like recreation. Practically all of the noncommercial acreage is in the West, Coastal Alaska, and the Plains States. The largest concentration, 69 million acres, is in the Southern Rocky Mountain Region. Other sizable blocks are in southern

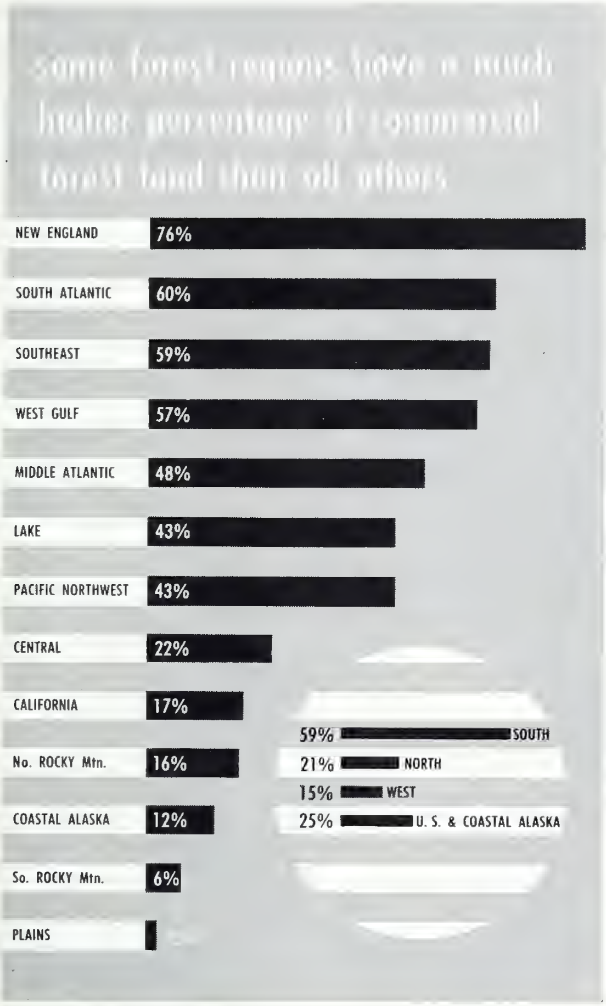

Figure 51

California and in Texas. In four regions, more than 50 percent of all the forest land is noncommercial: 84 percent in the Plains, 77 percent in the Southern Rocky Mountain Region, 74 percent in Coastal Alaska, and 59 percent in California. East of the Plains, only New York, Florida, and Minnesota have more than one million acres of noncommercial forest land (fig. 53).

Noncommercial forests are made up of various forest types. Productive but reserved lands, widely scattered through forest areas, carry the same types that appear on commercial forest land. This is also true—though to a lesser extent—of some of the unproductive forest areas such as the forested swamps in the Lake States; the precipitous coastal slopes in Coastal Alaska, with their sparse tree cover; and the extremely poor sites occurring mainly at the higher elevations in the West, and characterized generally by rocky, shallow soils. However, much of the unproductive acreage in the West occurs along the dry lower margins of commercial forests. Here the greatest acreage is in the pinyon pine-juniper type and the hardwood types:

Region:	*Pinyon pine-juniper (thousand acres)*	*Hardwood (thousand acres)*
Southern Rocky Mountain	50, 978	6, 180
California	6, 316	9, 233
Plains (west of 100th meridian)	938	3, 459
Northern Rocky Mountain	731	1, 378
Pacific Northwest	1, 537	364
Total	60, 500	20, 614

The noncommercial hardwood types are mostly woodland types in which the principal species is

Figure 52

TABLE 64.—*Acreage of commercial forest land in the major forest type groups of the eastern United States, by section and region, January 1, 1953*

Forest type group	Total, eastern United States	North						South			
		Total	New England	Middle Atlantic	Lake States	Central	Plains	Total	South Atlantic	Southeast	West Gulf
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Softwoods:											
White-red-jack pine	10, 299	9, 985	3, 418	1, 649	4, 445	31	[1] 442	314	208	106	------
Longleaf-slash pine	26, 491	------	------	------	------	------	------	26, 491	1, 564	22, 346	2, 581
Loblolly-shortleaf pine	58, 505	3, 737	165	2, 772	------	580	220	54, 768	16, 319	22, 751	15, 698
Spruce-fir	21, 462	21, 444	10, 560	868	10, 016	------	------	18	16	2	------
Total, softwoods	116, 757	35, 166	14, 143	5, 289	14, 461	611	662	81, 591	18, 107	45, 205	18, 279
Hardwoods:											
Oak-pine	22, 889	2, 445	49	564	------	1, 722	110	20, 444	5, 479	8, 704	6, 261
Oak-hickory	112, 214	58, 574	3, 180	18, 624	6, 443	28, 994	1, 333	53, 640	14, 919	24, 104	14, 617
Oak-gum-cypress	40, 293	4, 919	------	2, 716	------	1, 283	920	35, 374	7, 389	15, 993	11, 992
Elm-ash-cottonwood	18, 278	16, 828	824	1, 424	4, 609	7, 638	2, 333	1, 450	------	448	1, 002
Maple-beech-birch	33, 449	32, 660	10, 558	10, 732	9, 308	2, 062	------	789	258	531	------
Aspen-birch	23, 449	23, 449	1, 904	2, 876	18, 451	84	134	------	------	------	------
Total, hardwoods	250, 572	138, 875	16, 515	36, 936	38, 811	41, 783	4, 830	111, 697	28, 045	49, 780	33, 872
Total, all types	367, 329	174, 041	30, 658	42, 225	53, 272	42, 394	5, 492	193, 288	46, 152	94, 985	52, 151

[1] Four hundred forty-two thousand acres of ponderosa pine type.

TABLE 65.—*Acreage of commercial forest land in major western forest type groups of the western United States and Coastal Alaska, by section and region, January 1, 1953*

Forest type group	Coastal Alaska	Total, western United States	West					
			Pacific Northwest			California	Northern Rocky Mountain	Southern Rocky Mountain
			Total	Douglas-fir subregion	Pine subregion			
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Softwoods:								
Douglas-fir	------	31, 731	20, 141	18, 270	1, 871	4, 378	6, 222	990
Hemlock-Sitka spruce	4, 263	3, 551	3, 545	3, 518	27	6	------	------
Redwood	------	1, 590	2	2	------	1, 588	------	------
Ponderosa pine	------	37, 462	13, 403	678	12, 725	6, 057	7, 879	10, 123
White pine	------	5, 379	591	262	329	2, 255	2, 520	13
Lodgepole pine	------	14, 467	2, 054	207	1, 847	300	9, 649	2, 464
Larch	------	4, 422	1, 149	------	1, 149	------	3, 273	------
Fir-spruce	------	13, 619	3, 442	1, 634	1, 808	2, 733	2, 707	4, 737
Pinyon pine-juniper	------	855	------	------	------	------	855	------
Total	4, 263	113, 076	44, 327	24, 571	19, 756	17, 317	33, 105	18, 327
Hardwoods	6	3, 935	1, 038	884	154	------	735	2, 162
Total, all types	4, 269	117, 011	45, 365	25, 455	19, 910	17, 317	33, 840	20, 489

oak, but scattered stands of alder, tanoak, cottonwood, and other hardwood trees are also occasionally included. An additional 38 million acres of unproductive forest land occurs in the four regions west of the Plains, and supports chaparral, sparse stands of open-grown ponderosa pine, other hardwood types such as blue oak in California, and various conifer types such as Digger pine and knobcone pine.

Noncommercial Forest Lands Have Many Important Uses

Although most noncommercial areas have extremely limited value from the standpoint of timber production, they have other forest uses of great importance. The reserved areas include such forest lands as those in State and national parks and wilderness areas. Yellowstone National

TABLE 66.—*Noncommercial forest area of the United States and Coastal Alaska, by section and region, January 1, 1953*

Section and region	Total	Productive but reserved	Unproductive	
			Reserved	Unreserved
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*
North:				
New England	720	232	85	403
Middle Atlantic	2, 669	2, 552		117
Lake States	1, 929	718	32	1, 179
Central	332	247		85
Plains	29, 169	26	41	29, 102
Total	34, 819	3, 775	158	30, 886
South:				
South Atlantic	1, 136	668	39	429
Southeast	1, 921	387	186	1, 348
West Gulf	920	160	10	750
Total	3, 977	1, 215	235	2, 527
West:				
Pacific Northwest:				
Douglas-fir subregion	3, 592	1, 551	827	1, 214
Pine subregion	5, 172	688	556	3, 928
Total	8, 764	2, 239	1, 383	5, 142
California	25, 224	1, 202	1, 941	22, 081
Northern Rocky Mountain	21, 421	4, 518	4, 450	12, 453
Southern Rocky Mountain	69, 141	1, 612	2, 796	64, 733
Total	124, 550	9, 571	10, 570	104, 409
United States	163, 346	14, 561	10, 963	137, 822
Coastal Alaska	12, 239	183	701	11, 355
All regions	175, 585	14, 744	11, 664	149, 177

Park and the New York State Forest Preserve in the Adirondacks and Catskills are examples. As centers for recreation, most reserved forests receive intensive use. Not only are many of them good hunting, fishing, and camping grounds, but they include some of the most popular areas for winter sports and some of the most scenic attractions in the country. Much of the noncommercial forest is used for grazing livestock. It also provides forage and habitat for wildlife. For example, some of the higher slopes of the western mountains support mountain goats, bighorn sheep, ptarmigan, and other wildlife species. Wildlife is compatible with the many other uses of noncommercial forest and adds much to the pleasure people get from being in remote and forested areas.

The most important use of much noncommercial forest area is for watersheds. Much of the water for agriculture in the West, and for domestic and industrial purposes both there and in other regions, originates on high mountain slopes, many of which are classified as noncommercial forest land. The protective value of the chaparral type in California and in the Great Basin is far greater than the value of any trees which may grow on such areas. Likewise, the effect of forest vegetation in preventing erosion and in regulating streamflow is valued highly in many communities.

Nonforest Land

In addition to areas classified as forest land, there are others that support tree growth, even though they are not defined as forest land. They include isolated forest tracts of less than 1 acre in the East or less than 10 acres in the West; tree-covered areas in thickly populated urban and suburban sections; fencerows; orchards; and roadside, streamside, shelterbelt strips less than 120 feet wide; and areas from which the forest has been removed to less than 10 percent stocking and which have been developed for grazing, agricultural, residential, industrial, or other uses. In the aggregate, the area of these lands is probably much greater than generally realized.

THE OWNERSHIP PATTERN [22]

Commercial Forest Land Mostly Private

Commercial forest land ownership has several distinctive patterns (table 67, fig. 54). Most noticeable is that private ownership predominates nationally: 73 percent of all commercial forest land is in private holdings, 27 percent in public holdings. In the East, the proportion of private land is even higher, averaging 87 percent for the North and South combined. In the West, where a large acreage is in national forests and other public holdings, public ownership accounts for about two-thirds of the total; one-third is private.

Farm holdings represent the largest block of commercial forest land in private ownership. They include nearly half of all such land in the United States and Coastal Alaska. Somewhat more than one-third is in the "other private" class. In this class are a great number of owners of various kinds. Included are the nonforest industries, public utilities, various organizations, urban residents, and other individuals. Most farm and "other" private forest owners do not depend for their livelihood on timber use, or depend only to a minor degree. The smallest acreage in private ownership is held by the forest industries. The largest percentage of forest land owned by these industries is in the West. They control the least land in the North, only 10 percent of the total.

[22] A more complete discussion of forest ownership can be found under Ownership of Forest Land and Timber, p. 289.

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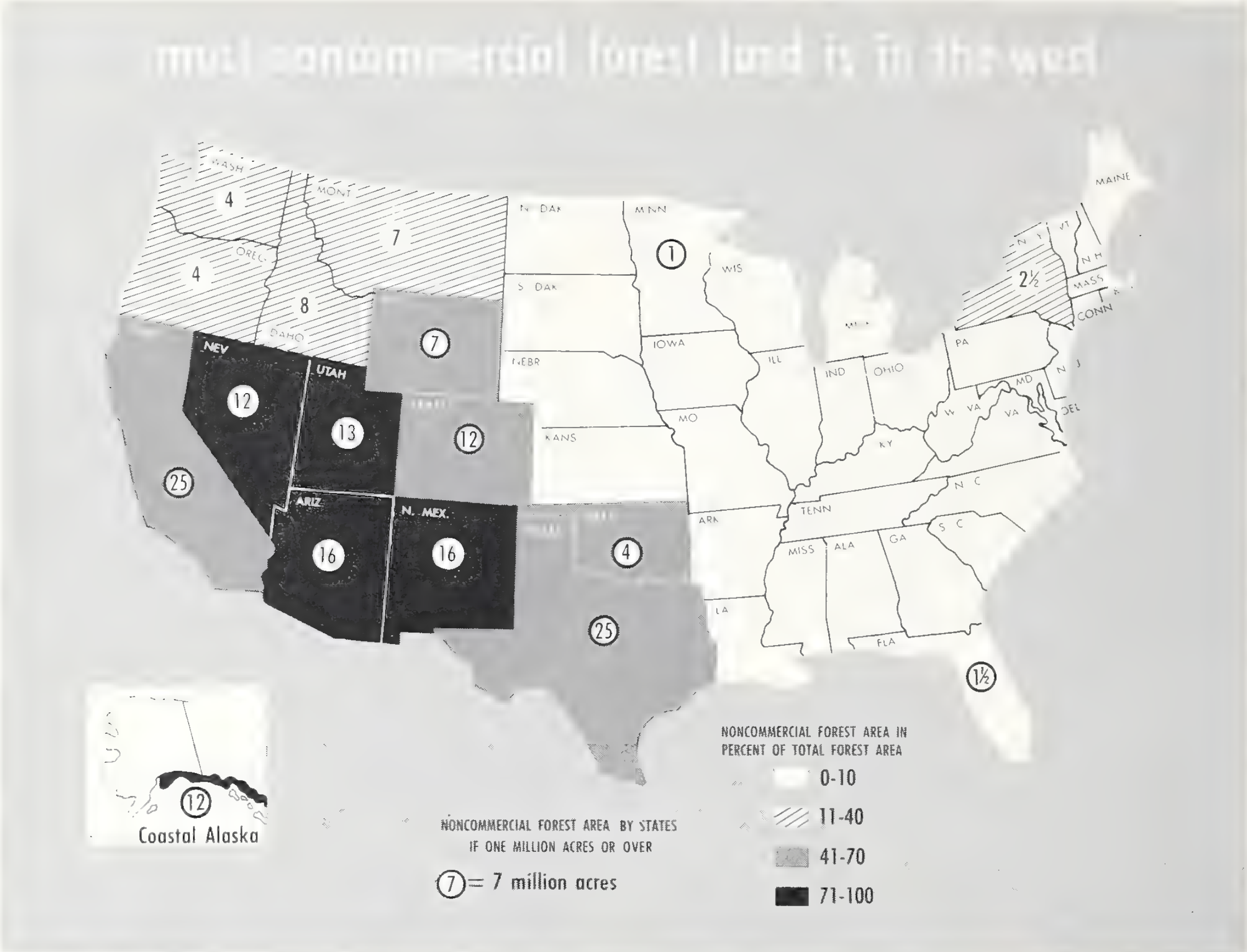

Figure 53

TABLE 67.—*Ownership of commercial forest land in the United States and Coastal Alaska, by section, January 1, 1953*

Ownership class	United States and Coastal Alaska	Coastal Alaska	Total, United States	North	South	West
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Private:						
Farm	165, 217		165, 217	61, 394	90, 143	13, 680
Forest industries	62, 382		62, 382	14, 103	33, 523	14, 756
Other	130, 670	19	130, 651	66, 118	52, 943	11, 590
Total	358, 269	19	358, 250	141, 615	176, 609	40, 026
Public:						
National forest	84, 759	3, 445	81, 314	10, 282	10, 372	60, 660
Other Federal	18, 365	805	17, 560	2, 812	3, 824	10, 924
State and local	27, 216		27, 216	19, 332	2, 483	5, 401
Total	130, 340	4, 250	126, 090	32, 426	16, 679	76, 985
All ownerships	488, 609	4, 269	484, 340	174, 041	193, 288	117, 011

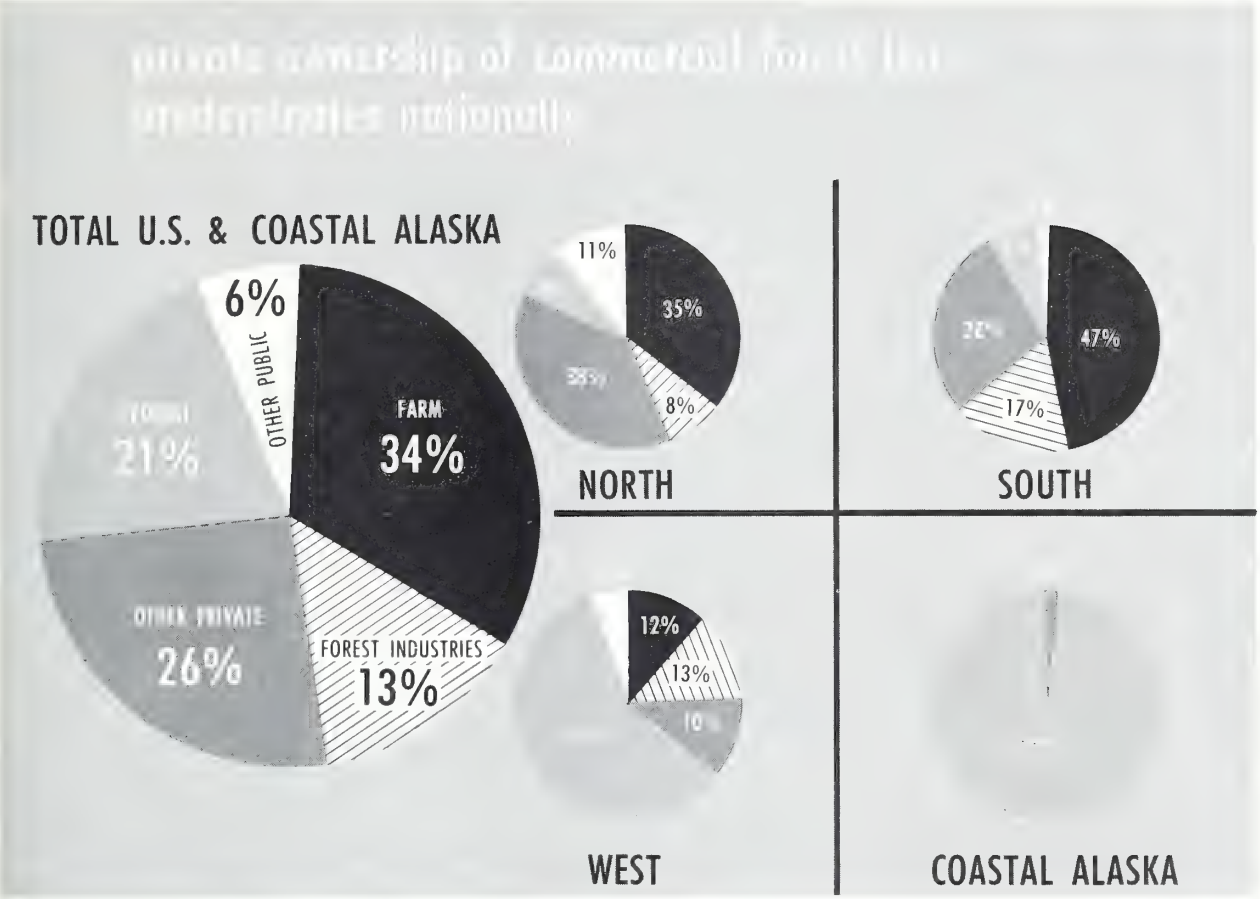

Figure 54

Sixty-five percent of the public holdings in the United States and Coastal Alaska are in national forests. State, county, municipal, and other local forest holdings make up 21 percent of the total, and other Federal lands, mostly administered by the Department of the Interior, 14 percent. Of the national-forest lands, totaling nearly 85 million acres, 72 percent are in the West, 12 percent in the South, 12 percent in the North, and 4 percent in Coastal Alaska.

State, county, and municipal lands are important segments of ownership in some sections. In the North, these holdings encompass 2½ times as much land as in the South and West combined. They account for nearly two-fifths of the commercial forest land in Minnesota, about one-fifth in Michigan, Pennsylvania, and Wisconsin, and more than 10 percent in Massachusetts. Washington is the only State outside the North where more than 10 percent of the commercial forest land is owned by State and local governments. Most of the public lands in this category in the cutover counties of the Lake States were acquired through tax delinquency.

Size of private holdings, by sections of the country, shows some striking differences too (table 68). Small holdings are especially typical of the eastern regions, where they account for 77 percent of all private land. In the West the percentage of large holdings is greater, amounting to 34 percent of the total, as compared to 11 percent in the North, 16 percent in the South, and 16 percent nationally. As is shown in another part of this report, the distribution of private lands by size of holding is closely related to the progress and status of forestry.

Noncommercial Forest Land Mostly Public

Nearly two-thirds of the noncommercial forest land in the United States and Coastal Alaska is in Federal ownership. State, county, and local public holdings are relatively small. Most of the remainder is privately owned.

The Federal noncommercial acreage is equally divided between national forest and other Federal holdings. Almost all of the portion in national

TABLE 68.—*Ownership of private commercial forest land in the United States and Coastal Alaska, by size, class of ownership, and section, 1953*

Section	All holdings	Small (less than 5,000 acres)	Medium (5,000 to 50,000 acres)	Large (more than 50,000 acres)
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*
North	141, 615	117, 160	8, 279	16, 176
South	176, 609	128, 192	20, 140	28, 277
West	40, 026	19, 912	6, 400	13, 714
United States	358, 250	265, 264	[1] 34, 669	[1] 58, 317
Coastal Alaska	19	19		
All sections	358, 269	265, 283	34, 669	58, 317

[1] Sectional estimates do not add to this national total because the holdings of a few owners are located in two sections. The national total has been adjusted to eliminate double counting of such holdings.

forests, some 55 million acres, is in the West and Coastal Alaska. Other Federal holdings, totaling about 56 million noncommercial acres, are also concentrated in the West, but there are some in Coastal Alaska and in the East.

Private, State, county, and local public areas of noncommercial forest land cover approximately 65 million acres. More than two-thirds of this is in the West, but there are also sizable areas in the North and in Coastal Alaska.

CONDITION OF COMMERCIAL FOREST LAND

Location and ownership of commercial forest land are only part of the story. It is equally important to know something about the condition of the land. Two criteria are commonly used by foresters: the distribution of area by stand size classes—that is, what portion supports sawtimber stands, poletimber stands, seedling and sapling stands—and how much is nonstocked. Another main criterion is the density or stocking of timber on forest land. Where old growth remains, foresters also distinguish between old-growth and young-growth sawtimber stands.

Sawtimber and Poletimber Stands Occupy Nearly Equal Areas

Sawtimber stands (the main source of present timber supplies) and poletimber stands each occupy more than one-third of the commercial forest land. The remainder, more than one-fourth, is occupied by seedling and sapling stands or is nonstocked. These proportions vary greatly between regions (table 69).

Sawtimber area constitutes a relatively high proportion of the commercial forest area in the West and Coastal Alaska:

	United States and Coastal Alaska (percent)	*East (percent)*	*West (percent)*	*Coastal Alaska (percent)*
Sawtimber stands	37	29	60	96
Poletimber stands	35	39	22	
Other stands and non-				2
stocked ares	28	32	18	2
Total	100	100	100	100

Eastern forests are characterized by large acreages of poletimber, saplings, and seedlings. Such stands, occupying 63 percent of the commercial forest land in the North and 60 percent in the South, hold promise of increasing sawtimber supplies from both of these sections in the future.

Not so promising is the acreage of nonstocked lands—8 to 10 percent of commercial forest area—in all sections except Alaska. Totaling some 42 million acres, this nonstocked land presently contributes little or nothing to the timber supply.

Old-Growth Sawtimber on 10 Percent of Commercial Forest Land

Of the 74 million acres of sawtimber stands in the West and Coastal Alaska, 50 million acres bear old-growth sawtimber.[23] While old growth accounts for 41 percent of the commercial forest land in these two sections, nationally it appears less important—about 10 percent of the total commercial forest area. In terms of timber volume, however, old-growth sawtimber is of great importance, both regionally and nationally. About three-fifths of it is in national forests; two-fifths is in private or other public ownership, as these 1953 estimates for the West and Coastal Alaska show:

Ownership class:	*Total commercial forest land (thousand acres)*	*Old-growth sawtimber (thousand acres)*	*Old-growth sawtimber (percent of total)*
National forest	64, 105	31, 570	49
Other ownerships	57, 175	18, 414	32
Total	121, 280	49, 984	41

One-third, 10 million acres, of national-forest old-growth is in the Pacific Northwest, and about one-tenth, 3 million acres, occurs in Coastal Alaska. The rest is distributed among national forests in other western regions—roughly 6 million acres in each Rocky Mountain region and in California. About two-thirds of the old growth in other ownerships is in the Pacific Northwest and California.

[23] There is still some old-growth sawtimber in the East, but it is scattered and its area is relatively small. For this reason, none of the East's sawtimber area has been classified as old growth except a small area of ponderosa pine in eastern South Dakota. Elsewhere in the East, the old-growth areas are included with young-growth sawtimber.

TABLE 69.—*Commercial forest area in the United States and Coastal Alaska, by stand-size class, section, and region, January 1, 1953*

Section and region	Total	Sawtimber stands	Poletimber stands	Seedling and sapling stands	Nonstocked areas [1]
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
North:					
New England	30, 658	10, 302	14, 501	4, 969	886
Middle Atlantic	42, 225	15, 002	16, 991	8, 842	1, 390
Lake States	53, 272	6, 457	16, 010	20, 370	10, 435
Central	42, 394	14, 486	15, 722	8, 957	3, 229
Plains	5, 492	1, 475	2, 289	1, 053	675
Total	174, 041	47, 722	65, 513	44, 191	16, 615
South:					
South Atlantic	46, 152	16, 833	18, 212	9, 631	1, 476
Southeast	94, 985	24, 505	37, 201	21, 097	12, 182
West Gulf	52, 151	19, 164	22, 963	7, 610	2, 414
Total	193, 288	60, 502	78, 376	38, 338	16, 072
West:					
Pacific Northwest:					
Douglas-fir subregion	25, 455	14, 611	4, 542	4, 260	2, 042
Pine subregion	19, 910	14, 065	3, 968	1, 227	650
Total	45, 365	28, 676	8, 510	5, 487	2, 692
California	17, 317	14, 038	1, 122	44	2, 113
Northern Rocky Mountain	33, 840	15, 039	11, 275	4, 710	2, 816
Southern Rocky Mountain	20, 489	12, 639	4, 612	1, 939	1, 299
Total	117, 011	70, 392	25, 519	12, 180	8, 920
United States	484, 340	178, 616	169, 408	94, 709	41, 607
Coastal Alaska	4, 269	4, 092	75	75	27
All regions	488, 609	182, 708	169, 483	94, 784	41, 634

[1] Including other stands that do not qualify as sawtimber, poletimber, or seedling and sapling stands. See stand-size definitions in appendix.

Although some of the old-growth stands are virgin timber, many—particularly in the ponderosa pine type—have been cut selectively. Such cuttings have resulted in thrifty, managed stands over a substantial part of the old-growth area in the West.

Large Share of Commercial Forest Land Is Understocked

Density or degree of stocking, another criterion of the condition of forest land, indicates to what extent growing space is occupied by present or potential sawtimber or poletimber trees of commercial species. Well-stocked stands are 70 percent or more stocked in relation to full stocking for comparable sites and stands; medium stocked stands are 40 to 70 percent stocked; poorly stocked stands are 10 to 40 percent stocked; nonstocked areas are less than 10 percent stocked. Nonstocked areas, poorly stocked stands, and even medium stocked stands are producing timber considerably below their potential. Excluding old-growth sawtimber stands, it is estimated that 17 percent of the remaining commercial forest land is poorly stocked, and that 9 percent is nonstocked (table 70).

When stocking is examined with respect to stand size, as in table 71, it is apparent that the younger stands have more than a proportionate share of poor stocking. Only 12 percent of the young-growth sawtimber area is poorly stocked, and 17 percent of the poletimber area, but 29 percent of seedling and sapling stands are in this category.

The combined acreage of poorly stocked seedling and sapling stands and nonstocked areas is 69 million acres. Most of it is in the East where two regions, the Southeast and the Lake States, account for more than half of it (fig. 55). This sizable area of idle forest land suggests one of the more outstanding opportunities for increasing the timber supply.

TABLE 70.—*Area and stocking of young-growth stands and nonstocked areas on commercial forest land in the United States and Coastal Alaska, by section and region, January 1, 1953*

Section and region	Total [1]	Well stocked		Medium stocked		Poorly stocked		Nonstocked	
	Thousand acres	*Thousand acres*	*Percent*	*Thousand acres*	*Percent*	*Thousand acres*	*Percent*	*Thousand acres*	*Percent*
North:									
New England	30, 658	23, 378	76	4, 177	14	2, 217	7	886	3
Middle Atlantic	42, 225	24, 839	59	11, 166	26	4, 830	12	1, 390	3
Lake States	53, 272	10, 910	20	15, 813	30	16, 114	30	10, 435	20
Central	42, 394	22, 412	53	11, 909	28	4, 844	11	3, 229	8
Plains	5, 467	1, 269	23	968	18	2, 555	47	675	12
Total	174, 016	82, 808	48	44, 033	25	30, 560	18	16, 615	9
South:									
South Atlantic	46, 152	31, 626	68	8, 619	19	4, 431	10	1, 476	3
Southeast	94, 985	32, 533	34	33, 365	35	16, 905	18	12, 182	13
West Gulf	52, 151	27, 377	52	16, 163	31	6, 197	12	2, 414	5
Total	193, 288	91, 536	48	58, 147	30	27, 533	14	16, 072	8
West:									
Pacific Northwest:									
Douglas-fir subregion	17, 987	7, 811	43	6, 220	35	1, 914	11	2, 042	11
Pine subregion	10, 000	4, 020	40	3, 618	36	1, 712	17	650	7
Total	27, 987	11, 831	42	9, 838	35	3, 626	13	2, 692	10
California	6, 077	1, 222	20	1, 318	22	1, 424	23	2, 113	35
Northern Rocky Mountain	24, 667	8, 636	35	7, 050	29	6, 165	25	2, 816	11
Southern Rocky Mountain	12, 250	3, 327	27	4, 230	35	3, 394	28	1, 299	10
Total	70, 981	25, 016	35	22, 436	32	14, 609	21	8, 920	12
United States	438, 285	199, 360	45	124, 616	29	72, 702	17	41, 607	9
Coastal Alaska	315	230	73	49	15	9	3	27	9
All regions	438, 600	199, 590	46	124, 665	28	72, 711	17	41, 634	9

[1] Excluding 50,009,000 acres of old-growth sawtimber stands.

TABLE 71.—*Area and stocking of young-growth stands on commercial forest land in the United States and Coastal Alaska, by stand-size class, January 1, 1953*

Stand-size class	Total [1]	Well stocked	Medium stocked	Poorly stocked	Nonstocked
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Sawtimber stands	132, 699	80, 124	36, 624	15, 951	
Poletimber stands	169, 483	84, 877	55, 115	29, 491	
Seedling and sapling stands	94, 784	34, 589	32, 926	27, 269	
Nonstocked area	41, 634				41, 634
Total	438, 600	199, 590	124, 665	72, 711	41, 634

[1] Excluding 50,009,000 acres of old-growth sawtimber stands where stocking was not measured.

TRENDS IN FOREST LAND AREA

In 1630, according to one estimate, the forest land area of continental United States was 950 million acres or about one-half of the total land area of the country. Through clearing for agriculture and settlement, especially in the East, the forests decreased in area until about the first part of the twentieth century.

Nationwide estimates of forest land using the general terminology and broad concepts of the present day were made in 1920, 1930, and 1938. These estimates, varying from 614 to 630 million acres, were based on limited survey data. Since 1938 the area data have been more dependable because of the progress in the nationwide Forest Survey. By 1945 the Forest Survey had covered about 60 percent of the commercial forest area and, by 1953, 86 percent. Thus, data for 1945

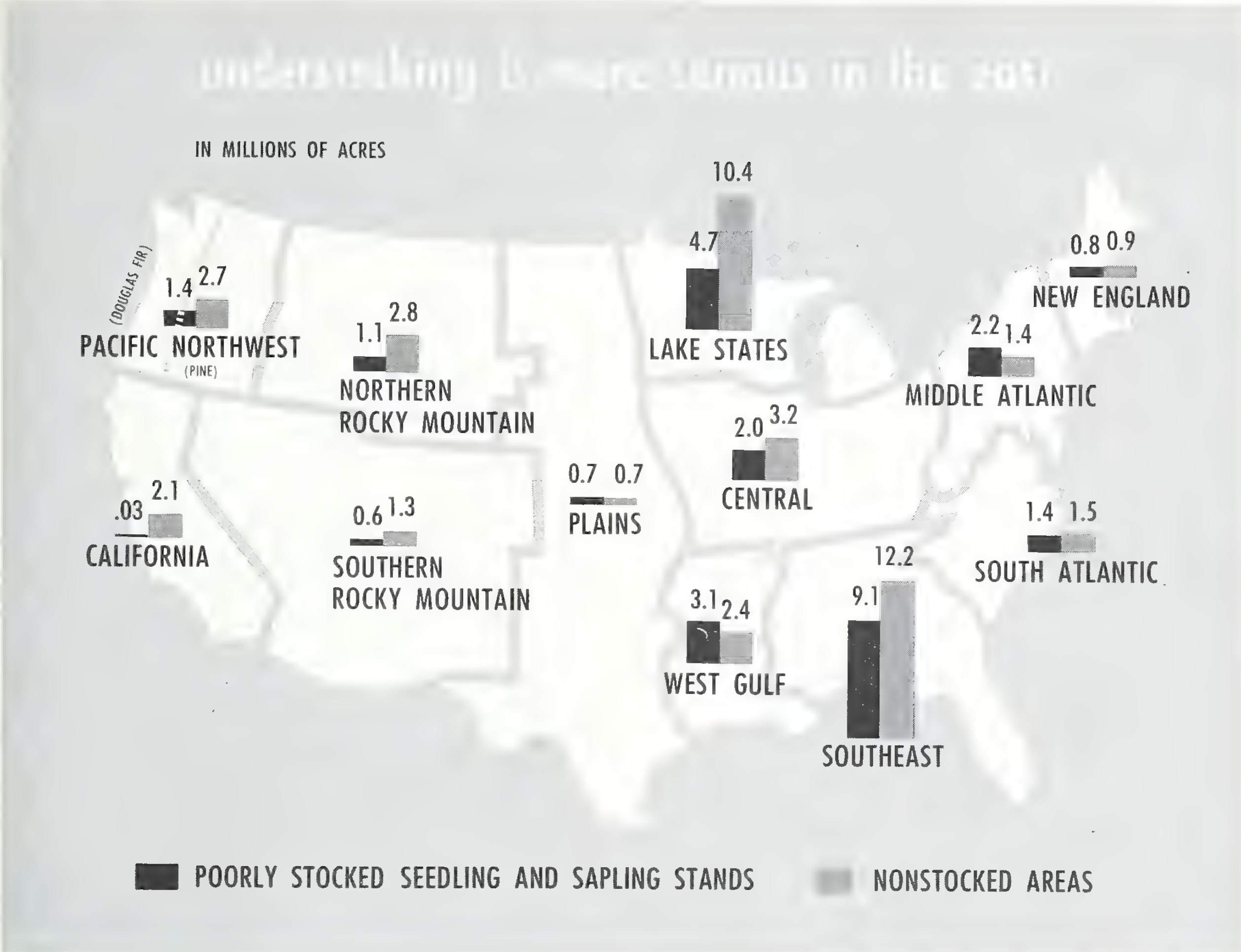

Figure 55

and 1953 have a much greater reliability than those of previous years:

Year of estimate:	*Total forest land area (million acres)*	*Commercial forest land area (million acres)*	*Noncommercial forest land area (million acres)*
1630 [1]	950	850	100
1920 [2]	614	464	150
1930 [3]	615	495	120
1938 [4]	630	462	168
1945 [5]	624	461	163
1953	648	485	163

[1] Kellogg, R. S., *The Timber Supply of the United States.* U. S. Dept. Agr., Forest Serv. Cir. 97, 16 pp., illus. 1907.
[2] U. S. Forest Serv. *Timber Depletion, Lumber Prices, Lumber Exports and Concentration of Timber Ownership.* Ed. 2. Rpt. on Sen. Res. 311, 66th Cong., 2d Sess. 73 pp., illus. (Capper Rpt.) 1920.
[3] U. S. Forest Serv. *A National Plan for American Forestry.* Sen. Doc. 12, 73d Cong., 1st Sess. 2 v., 1,677 pp., illus. (Copeland Rpt.) 1933.
[4] Cong. U. S., Joint Committee on Forestry. *Forest Lands of the United States.* Sen. Doc. 32, 77th Cong., 1st Sess. 44 pp., illus. (Joint Congressional Committee Rpt.) 1941.
[5] U. S. Forest Serv. *Forests and National Prosperity.* U. S. Dept. Agr. Misc. Pub. 668, 99 pp., illus. (Reappraisal Rpt.) 1948.

Forest Land Area Now Greater Than in 1945

Forest land area as of 1953 totaled 648 million acres. This was 23.8 million acres more than was estimated in 1945; all of the increase except 0.5 million acres was commercial forest land. The difference is attributable to three main factors: changes in classification and in land use and improved accuracy of area estimates.

In the South, over 10 million acres of abandoned agricultural land were added to the commercial forest area. Almost as many acres were added to the estimate of commercial forest area in the West when major shifts from the noncommercial to the commercial class were made in the estimates for the Rocky Mountain States. In the North, nearly 4 million acres were added, mainly by reclassifying forested swamps and poor aspen sites and, in the Plains States, by more accurate area determinations.

In addition, there were shifts resulting from clearing land for reservoir sites, parks, rights-of-

way, and other urban uses. For these new uses, some 2 million acres of commercial forest area have been required since 1945. On the other hand, somewhat over 600,000 acres were added when certain military reservations, municipal watersheds, parks, and national-forest lands previously withdrawn were released from cutting restrictions.

Although the estimate of total noncommercial forest area in 1953 was about the same as in 1945, there were some rather large differences in a few regions. The noncommercial forest area in the West increased by 6.8 million acres. In the Southern Rocky Mountain Region, over 12 million acres were added by including hardwood and pinyon pine-juniper types once considered as nonforest. Half of this increase was offset by reductions in noncommercial area classification in California and the Northern Rocky Mountain Region. In the Lake States and Plains regions, forest land classified as noncommercial in 1945 was classified as commercial in 1953. Changes of noncommercial area in the South were minor.

Timber Use Competes With Other Land Uses

As the national economy expands, competition for the use of land will inevitably increase. In the past, the acreage of commercial forest land has been affected chiefly by competition from agriculture. Other nontimber uses also can be expected to have an important effect on the acreage used for timber production in the future.

In 1952, some 3.3 million acres of commercial forest land were cut with reported intent of conversion from forest to other land use. Since about 90 percent of this acreage was in small private holdings in the East, most of it was probably cleared for agriculture. However, the acreage of marginal farm land returned to forest more than offset the acreage cleared, as it has for the past 50 years.

This shifting of land use between forestry and agriculture began in colonial times. Until the opening of the 20th century, clearing for farm use caused a steady decline in forest area, but for the last several decades the area returned to forest seems to have exceeded the area cleared.

The change in trend has been due to a number of changes in agriculture. In the latter half of the 19th century, the great westward flow of population from New England and other eastern regions to the Prairie States and the nonforest and agricultural lands in the West released millions of eastern acres which had been farmed. The westward migration was still in progress when the automobile and then the gasoline tractor released millions of additional acres that had been needed to provide feed for horses. In the South, the boll weevil and economic problems in cotton farming also caused large acreages of farm land to be abandoned. Other substantial areas in the cutover counties of the Lake States proved uneconomic for farming and reverted to forest during the last few decades.

This great readjustment in the area devoted to crops and pastures has about run its course in the North. It has probably passed its peak in the South. And in the West it has never been more than of local importance. It is unlikely that there will be any comparable downward adjustment in agricultural acreage in the future. Rather, further loss of forest area to agriculture seems likely, even though technology and economics are still tending to concentrate agricultural production on the better lands and to free poorer lands for forestry.

In the shifting of land between timber and other uses, another factor is the increasing importance of watershed management. In most agricultural regions, there is a sizable acreage of nonforest land which, because of steepness, susceptibility to erosion, or other reasons, may eventually be planted to forest trees as a watershed protection measure. Some of these areas will also be used for timber production. Working in the opposite direction is the inundation of commercial forest land resulting from new reservoir construction.

The area available for timber growing is being steadily reduced by urban and industrial development. Not only is the urban population growing in numbers, but the current trend toward suburban living is increasing per-capita space requirements. Similarly, the requirements for industrial growth are magnified by the current trend toward decentralization, with one-story plant layouts and ample space for parking of employees' cars and for expansion.

Rights-of-way for highways, including timber access roads, pipelines, powerlines, and communication lines also encroach upon the area available for timber growing. The construction of new superhighways is of increasing importance in this category, while use of radio tends to reduce further demands for communication lines. All together, such special uses may require more new land than urban and industrial expansion with which they are associated.

Setting aside of forest land for recreational use is more likely to be of importance than any of the factors mentioned except clearing for agriculture, though not all recreation requires curtailment of other uses. Nevertheless, the pressing need for development of recreational areas probably will be met by withdrawing a certain acreage of forest land from commercial use. Recreational facilities in national forests, national parks, and other public forest lands probably will be greatly expanded to meet growing demands. Along with such needs

is the growing demand for the reservation of strips of timber along forest highways.

The acreage devoted to timber growing in the future will reflect the give and take of competition with agriculture, water, recreation, and other land uses. However, it seems likely that the upswing in forest area which started about 1910 has run its course and that the underlying and historic downward trend will soon be resumed.

TIMBER VOLUME

In contrast to the foregoing discussion of forest land, the following account is concerned primarily with the timber resource. In appraising this resource, important considerations include the regional distribution of the timber, and its species composition, quality, ownership, and accessibility. Such an appraisal places emphasis on the volume of standing timber on commercial forest land; the timber on noncommercial forest land and on nonforest land is of minor importance.

Volume on Commercial Forest Land

For the rest of this century, almost all of the Nation's domestic wood supply will be harvested from trees that are now standing on the commercial forest land. As of the beginning of 1953, these trees contained more than 600 billion cubic feet of sound wood (table 72). Of this, 86 percent, or 517 billion cubic feet, is classified as forest growing stock. The balance, 14 percent, includes the sound volume of cull trees, salvable dead trees, and hardwood limbs.

The forest growing stock is the significant portion of the timber resource. Nearly three-fourths of it is in sawtimber trees; the other fourth is in poletimber trees—smaller trees that may become sawtimber trees in the future.

The total net volume of sawtimber on commercial forest land is 2,094 billion board-feet, measured by the International ¼-inch log rule. All of it is in the saw-log portions of sawtimber trees—2,057 billion board-feet in live sawtimber trees and 37 billion board-feet in salvable dead sawtimber trees. Softwood species account for four-fifths of the total sawtimber volume; one-fifth is hardwood. Since live sawtimber comprises the bulk of the timber that is suitable for lumber and most other present uses, this discussion of the timber resources emphasizes the board-foot estimates of sawtimber volume.

Two-thirds of Sawtimber Volume Is in the West

Two-thirds of all the live sawtimber in the United States and Coastal Alaska is in the four western regions where it is remote from consumers, more than four-fifths of whom live in the East (table 73 and fig. 56). Coastal Alaska, generally thought of as a large reservoir of softwood, has about 89 billion board-feet, or only 4 percent of the total. The balance is in the East, 17 percent in the South and 13 percent in the North. The fact that three States—Oregon, Washington, and California—contain 54 percent of all the sawtimber volume (table 74), has resulted in a heavy concen-

Table 72.—*Net volume of all timber and sawtimber on commercial forest land in the United States and Coastal Alaska, by class of material, softwood and hardwood, January 1, 1953*

ALL TIMBER

Class of material	Total		Softwood	Hardwood
	Billion cu. ft.	*Percent*	*Billion cu. ft.*	*Billion cu. ft.*
Growing stock:				
Live sawtimber trees:[1]				
Saw-log portions	331	55	262	69
Upper stems	48	8	29	19
Total	379	63	291	88
Live poletimber trees[2]	138	23	64	74
Total, growing stock	517	86	355	162
Cull trees	56	9	18	38
Salvable dead trees:				
Sawtimber trees[1]	8	1	7	1
Poletimber trees[2]	1	(4)	1	(3)
Hardwood limbs	23	4	------	23
Total, all timber	605	100	381	224
	Percent		*Percent*	*Percent*
Proportion of total	100	------	63	37

SAWTIMBER[5]

Class of material	Total		Softwood	Hardwood
	Billion bd.-ft.	*Percent*	*Billion bd.-ft.*	*Billion bd.-ft.*
Live sawtimber trees[1]	2,057	98	1,648	409
Salvable dead sawtimber trees[1]	37	2	34	3
Total, sawtimber volume	2,094	100	1,682	412
	Percent		*Percent*	*Percent*
Proportion of total	100	------	80	20

[1] Trees of commercial species that contain at least one merchantable saw log as defined by regional practice and that are of the following minimum diameters at breast height: Eastern regions: Softwoods 9.0 inches, hardwoods 11.0 inches. Western regions: All species 11.0 inches.

[2] Trees of commercial species that meet regional specifications of soundness and form, and are of the following diameters at breast height: Eastern regions: Softwoods 5.0 to 9.0 inches, hardwoods 5.0 to 11.0 inches. Western regions: All species 5.0 to 11.0 inches.

[3] Less than 500 million cubic feet.

[4] Less than 0.5 percent.

[5] Included in all-timber cubic volume but also measured in board-feet.

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TABLE 73.—*Regional distribution of live sawtimber volume and growing stock on commercial forest land in the United States and Coastal Alaska, softwood and hardwood, January 1, 1953*

Section and region	Sawtimber [1]			Growing stock		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Billion bd.-ft.	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*
North:						
New England	51	27	24	24	10	14
Middle Atlantic	74	13	61	34	5	29
Lake States	50	14	36	25	7	18
Central	83	4	79	25	1	24
Plains	8	1	7	3	(3)	3
Total	266	59	207	111	23	88
South:						
South Atlantic	107	51	56	34	15	19
Southeast	139	77	62	48	23	25
West Gulf	111	55	56	32	13	19
Total	357	183	174	114	51	63
West:						
Pacific Northwest:						
Douglas-fir subregion	595	577	18	113	108	5
Pine subregion	154	154	(2)	33	33	(3)
Total	749	731	18	146	141	5
California	360	354	6	66	63	3
Northern Rocky Mountain	167	166	1	43	42	1
Southern Rocky Mountain	69	66	3	18	16	2
Total	1, 345	1, 317	28	273	262	11
United States	1, 968	1, 559	409	498	336	162
Coastal Alaska	89	89	(2)	19	19	(3)
All regions	2, 057	1, 648	409	517	355	162

[1] In addition to the live sawtimber volume, there are 37 billion board-feet of sawtimber in salvable dead trees; of this total 34 billion board-feet are in the West, 2 billion in the North, 1 billion in the South.

[2] Less than 0.5 billion board-feet.

[3] Less than 0.5 billion cubic feet.

tration of lumber industry in the Pacific Coast States.

From region to region, the volume of sawtimber varies considerably. For example, the average volume per acre of commercial forest land in the West is 11,500 board-feet; in California it is 20,800 board-feet, and in the adjacent Southern Rocky Mountain Region 3,400 board-feet. Likewise, in the East where the average volume per acre is 1,700 board-feet, the average is 900 board-feet in the Lake States and 2,300 in the South Atlantic States. Such variations affect the economic prospects of the dependent forest industries. They also emphasize the wide range in timber values found on the forest land.

The growing stock is more evenly distributed: 53 percent is in the West and 3 percent occurs in Coastal Alaska. The remainder, 44 percent, is in the East. However, there is wide regional variation too. For example, the 17 million acres of commercial forest land in California carry over 2½ times the growing stock volume found on 53 million acres in the Lake States. The volume of growing stock in the Douglas-fir subregion, alone, nearly equals the total found in the entire South.

Softwood Species Comprise Four-fifths of Sawtimber Volume

Softwood trees make up 80 percent of the Nation's sawtimber volume; the balance is in hardwood trees (table 72). Nationally, Douglas-fir is the most abundant species; it comprises one-fourth of the total sawtimber volume (table 75)

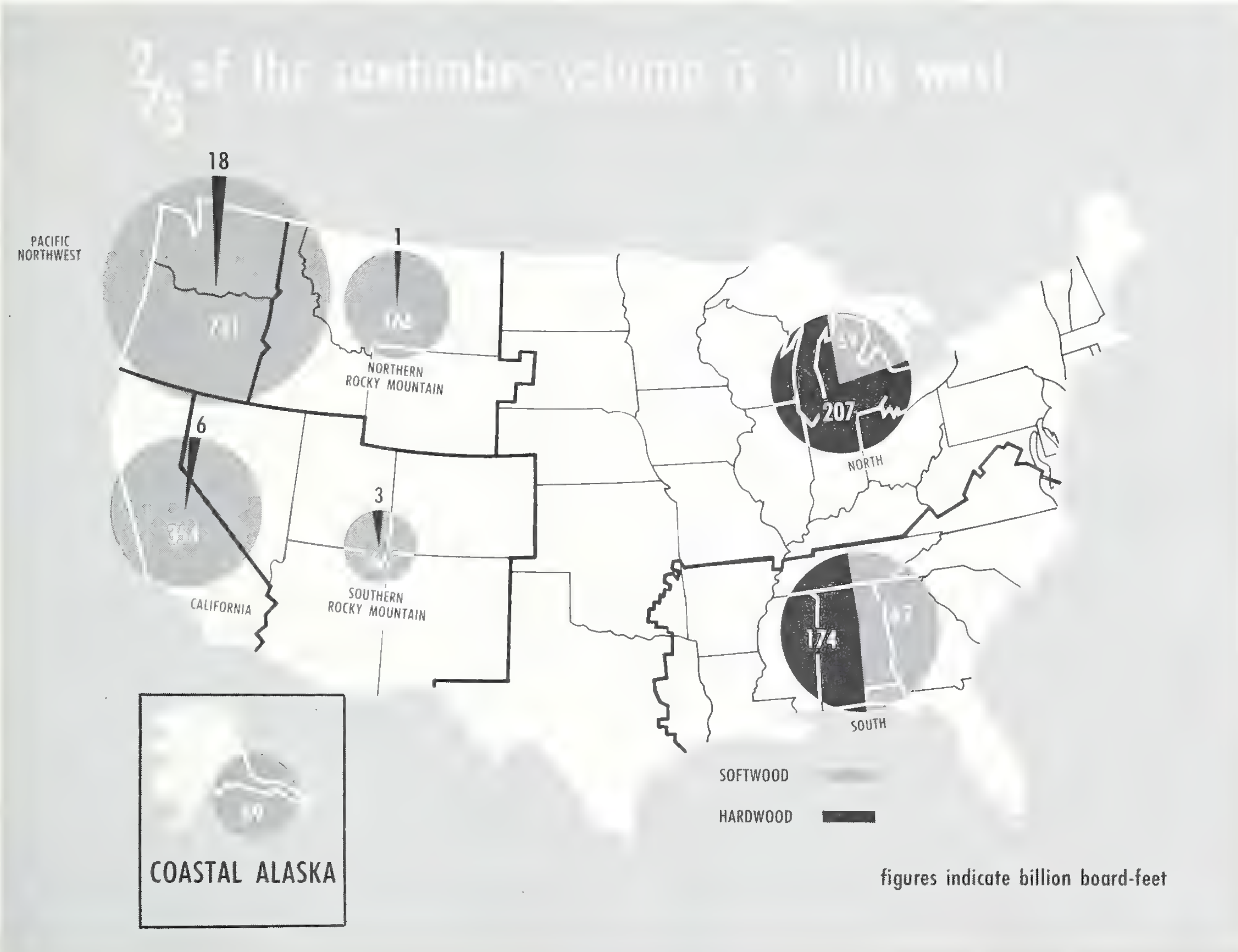


Figure 56

It is of course the major western species (table 76), accounting for half of the sawtimber volume in the Pacific Northwest, one-third in California, and more than one-fourth in the Northern Rocky Mountain Region. Ponderosa pine is also an abundant western species, though exceeded by western hemlock in the Pacific Northwest and by the true firs in California. Although not widely distributed, western white pine in the Inland Empire and redwood in California are of considerable importance because of their high value and specialty uses.

The commercial forests of Coastal Alaska are nearly all softwood, principally Sitka spruce and western hemlock (table 77). Less than one percent of their sawtimber volume is hardwood.

The North is hardwood country (table 78). Nearly four-fifths of its sawtimber volume is in hardwood trees and its stands carry half of all the hardwood sawtimber in the country. The forests of the Central States Region, with sizable volumes of oak and hickory, are more than 95 percent hardwood. New England forests, with high proportions of spruce, balsam fir, and white pine, are only 47 percent hardwood.

In the three southern regions, the volumes of softwood and hardwood sawtimber are nearly equal. Almost all of the softwood is in the four important southern yellow pines—longleaf, slash, loblolly, and shortleaf pine (table 79). Longleaf and slash pines predominate in the Southeast, while loblolly and shortleaf pines are widely distributed throughout the South. Cypress—most of it in the Southeast Region—is the only other southern softwood of note. More than two-fifths of the Nation's hardwood sawtimber is in the South

TABLE 74.—*Net volume of live sawtimber and growing stock on commercial forest land in the United States and Coastal Alaska, by section, region, and State, January 1, 1953*

Section, region, and State	Sawtimber	Growing stock
	Million bd.-ft.	*Million cu. ft.*
North:		
New England:		
Connecticut	1, 859	1, 304
Maine	28, 226	12, 601
Massachusetts	2, 659	1, 871
New Hampshire	10, 069	4, 452
Rhode Island	165	161
Vermont	8, 547	3, 956
Total	51, 525	24, 345
Middle Atlantic:		
Delaware	1, 234	464
Maryland	6, 771	2, 899
New Jersey	1, 660	952
New York	26, 883	11, 675
Pennsylvania	19, 306	10, 629
West Virginia	18, 497	7, 864
Total	74, 351	34, 483
Lake States:		
Michigan	21, 141	9, 912
Minnesota	12, 538	7, 235
Wisconsin	16, 111	8, 071
Total	49, 790	25, 218
Central:		
Illinois	11, 694	3, 050
Indiana	11, 671	3, 041
Iowa	4, 119	1, 183
Kentucky	27, 342	7, 834
Missouri	13, 195	5, 503
Ohio	14, 650	4, 013
Total	82, 671	24, 624
Plains:		
Kansas	3, 371	954
Nebraska	1, 253	462
North Dakota	653	251
Oklahoma (west)	880	337
South Dakota (east)	790	601
Texas (west)	730	223
Total	7, 677	2, 828
Total, North	266, 014	111, 498
South:		
South Atlantic:		
North Carolina	44, 152	13, 642
South Carolina	32, 299	9, 613
Virginia	30, 407	10, 503
Total	106, 858	33, 758

TABLE 74.—*Net volume of live sawtimber and growing stock on commercial forest land in the United States and Coastal Alaska, by section, region, and State, January 1, 1953*—Continued

Section, region, and State	Sawtimber	Growing stock
	Million bd.-ft.	*Million cu. ft.*
South:—Continued		
Southeast:		
Alabama	38, 211	11, 713
Florida	23, 032	8, 152
Georgia	36, 920	12, 692
Mississippi	25, 789	9, 628
Tennessee	15, 350	5, 770
Total	139, 302	47, 955
West Gulf:		
Arkansas	38, 317	11, 762
Louisiana	41, 436	11, 199
Oklahoma (east)	5, 580	1, 780
Texas (east)	25, 575	7, 247
Total	110, 908	31, 988
Total, South	357, 068	113, 701
West:		
Pacific Northwest:		
Douglas-fir subregion	594, 375	113, 171
Pine subregion	154, 501	33, 023
Total	748, 876	146, 194
Oregon	433, 809	80, 973
Washington	315, 067	65, 221
Total	748, 876	146, 194
California	360, 001	66, 711
Northern Rocky Mountain:		
Idaho	96, 015	21, 246
Montana	55, 770	16, 143
South Dakota (west)	3, 167	1, 287
Wyoming	12, 070	4, 087
Total	167, 022	42, 763
Southern Rocky Mountain:		
Arizona	19, 988	3, 700
Colorado	25, 394	8, 037
Nevada	572	151
New Mexico	15, 054	3, 683
Utah	7, 800	2, 001
Total	68, 808	17, 572
Total, West	1, 344, 707	273, 240
United States	1, 967, 789	498, 439
Coastal Alaska	89, 058	18, 496
All regions	2, 056, 847	516, 935

TABLE 75.—*Net volume of live sawtimber and growing stock on commercial forest land in the United States and Coastal Alaska, by species group, January 1, 1953* [1]

Species	Saw-timber	Growing stock
	Billion bd.-ft.	*Billion cu. ft.*
Eastern softwoods:		
Southern yellow pine	174	49
Spruce and balsam fir	19	8
White and red pine	17	5
Cypress	13	4
Hemlock	12	4
Jack pine	2	1
Other	5	3
Total	242	74
Eastern hardwoods:		
White oak [2]	35	
Red oak [3]	31	53
Other oaks	80	
Beech, yellow birch, and sugar maple	51	19
Sweetgum	26	9
Tupelo and blackgum	25	9
Hickory	24	9
Yellow-poplar	16	5
Cottonwood and aspen	9	8
Other	84	39
Total	381	151
Total, eastern species	623	225
Western softwoods:		
Douglas-fir	532	98
Ponderosa and Jeffrey pine	224	43
Western hemlock and Sitka spruce	208	43
True firs	184	38
Sugar and western white pine	57	10
Engelmann and other spruce	37	8
Redwood	36	6
Lodgepole pine	30	15
Western larch	28	5
Other	70	15
Total	1, 406	281
Western hardwoods:		
Cottonwood and aspen	4	2
Red alder	9	4
Other	15	5
Total	28	11
Total, western species	1, 434	292
Total, all species	2, 057	517

[1] Species volumes by States are given in the appendix.
[2] *Quercus alba* and *Q. prinus.*
[3] *Quercus borealis, Q. falcata* var. *pagodaefolia,* and *Q. shumardii.*

TABLE 76.—*Net volume of live sawtimber by species group, West, January 1, 1953*

Species	Volume	
	Billion bd.-ft.	*Percent*
Softwoods:		
Douglas-fir	532	40
Ponderosa and Jeffrey pine	224	17
True firs	184	14
Western hemlock and Sitka spruce	127	9
Sugar and western white pine	57	4
Engelmann and other spruces	37	3
Redwood	36	3
Western redcedar	32	2
Lodgepole pine	30	2
Western larch	28	2
Other softwoods	30	2
Total softwoods	1, 317	98
Hardwoods	28	2
Total, all species	1, 345	100

TABLE 77.—*Net volume of live sawtimber, by species group, Coastal Alaska, January 1, 1953*

Species	Volume	
	Billion bd.-ft.	*Percent*
Softwood:		
Western hemlock	54	61
Sitka spruce	27	30
Western redcedar	5	5
Other softwood	3	4
Total softwood	89	100
Hardwood	(1)	(2)
Total, all species	89	100

[1] Less than 500 million board-feet.
[2] Less than 0.5 percent.

For commercial use, all sawtimber species are not equally valuable. Currently more than 80 percent of the lumber is sawed from some 10 species, yet these species represent only about 65 percent of the sawtimber volume. Most softwoods enjoy wide acceptance, but some, such as the true firs and western hemlock, though relatively abundant, are in smaller demand than less plentiful species like white pine and redwood.

Because there are many species, widely scattered, the preferences for hardwoods are difficult to generalize. Among the oaks, the better quality white oak and red oak are highly esteemed, but the poorer quality species grouped under "other

red oaks" and "other white oaks" are often difficult to market. For many purposes, consumers prefer sweetgum to tupelo and blackgum; sugar maple to soft maple; yellow birch to beech; black walnut, ash, and yellow-poplar to hickory, cottonwood, and aspen. For certain special uses there are long-standing species preferences: white hickory handles, paper birch turning squares, white oak staves, birdseye maple veneers, and so on. While one softwood species can be substituted for another in many cases, without much effect on costs, the substitution of one hardwood for another is frequently more expensive and less satisfactory because of the wide variation in wood characteristics and the specialized nature of so many hardwood uses. Thus, in gaging the hardwood sawtimber supply, an important factor is consumers' preference for particular species.

Growing stock is the net volume of sound wood in all trees 5.0 inches in diameter or larger that are now or prospectively suitable for conversion into merchantable saw logs. Of the total growing stock, softwood species account for 69 percent, and 31 percent is hardwood. Douglas-fir, oak, and southern yellow pine are the most abundant

TABLE 78.—*Net volume of live sawtimber, by species group, North, January 1, 1953*

Species	Volume	
	Billion bd.-ft.	*Percent*
Softwoods:		
Spruce and balsam fir	19	7
White and red pine	16	6
Hemlock	11	4
Other softwoods [1]	13	5
Total softwoods	59	22
Hardwoods:		
Oak:		
Red oak [2]	24	9
White oak [3]	20	8
Other red oak	20	7
Other white oak	11	4
Total	75	28
Sugar maple	22	8
Beech	13	5
Yellow birch	12	5
Soft maples	10	4
Hickory	9	3
Cottonwood and aspen	8	3
Yellow-poplar	7	3
Other hardwoods	51	19
Total hardwoods	207	78
Total, all species	266	100

[1] Including 294 million board-feet of ponderosa pine in the Plains Region.

[2] *Quercus alba* and *Q. prinus.*

[3] *Quercus borealis, Q. falcata* var. *pagodaefolia,* and *Q. shumardii.*

TABLE 79.—*Net volume of live sawtimber, by species groups, South, January 1, 1953*

Species	Volume	
	Billion bd.-ft.	*Percent*
Softwoods:		
Southern yellow pine:		
Shortleaf and loblolly pine	121	34
Longleaf and slash pine	37	10
Other southern yellow pine	10	3
Total	168	47
Cypress	12	3
Other softwoods	3	1
Total softwoods	183	51
Hardwoods:		
Oak:		
White oak [1]	15	4
Red oak [2]	7	2
Other red oak	33	9
Other white oak	16	5
Total	71	20
Sweetgum	24	7
Tupelo and blackgum	23	6
Hickory	15	4
Yellow-poplar	9	3
Other eastern hardwoods	32	9
Total hardwoods	174	49
Total, all species	357	100

[1] *Quercus alba* and *Q. prinus.*

[2] *Quercus borealis, Q. falcata* var. *pagodaefolia,* and *Q. shumardii.*

species, but, as with sawtimber, the species composition of the growing stock shows great variation. In the West, and in Coastal Alaska, softwoods make up almost all of the growing stock, but in the East two-thirds is hardwood.

Nearly 10 Percent of All Timber Volume Is in Cull Trees

Of the 605 billion cubic feet of timber of all species in the United States and Coastal Alaska, cull trees, salvable dead trees, and hardwood limbs account for nearly 15 percent, none of it growing stock. In hardwoods, the proportion is even higher, amounting to 28 percent of the total cubic volume of hardwood timber. A little of this material is finding its way into markets and in the East, for example, some cull trees are now used for pulpwood. In the West, salvable dead trees, including windthrown, fire- and insect-killed trees, are logged for lumber, veneer, and pulpwood. Thus in the Douglas-fir region nearly half of the dead timber on the Tillamook Burn has been salvaged.

In all, there are 88 billion cubic feet of sound wood in dead and cull trees and in hardwood limbs: cull trees contain about 60 percent of this

material; salvable dead trees, 10 percent; and limbs about 30 percent (table 80).

The net volume of sound wood in cull trees, 56 billion cubic feet, is widely distributed—about 43 percent in the South, 30 percent in the North, and 27 percent in the West and Coastal Alaska. In the East, most of the cull-tree volume is hardwood, 37 billion out of 41 billion cubic feet, and more than half of it is in sound cull trees. In the West and Coastal Alaska, softwood accounts for 14 billion cubic feet of the total cull tree volume of 15 billion cubic feet; nearly all this total volume of sound wood is in rotten cull trees.

The net volume of sound wood in salvable dead trees is 9 billion cubic feet, including 37 billion board-feet of salvable dead sawtimber volume. Almost 90 percent is in the West; the East has less than 1 billion cubic feet, mostly dead chestnut. In sawtimber terms, the salvable dead softwood in the West measures some 34 billion board-feet, of which 23 billion occurs in the Douglas-fir subregion alone.

Hardwood limb volume, 23 billion cubic feet, is concentrated in the East. More than half of it is in the North.

Additional Volume on Other Land

In addition to the timber on commercial forest land, there is considerable timber on noncommercial forest land and on nonforest land. Since most of this timber has no commercial value or is restricted from cutting, no estimate has been made of its total volume.

The forest lands withdrawn from timber use for parks, monuments, and natural and wilderness areas carry a substantial volume of sawtimber. Other noncommercial forest lands, such as subalpine forests and swamps, often have much small timber and in the aggregate this volume may be considerable, too. The extensive areas of pinyon pine-juniper and noncommercial hardwood types in the West and Plains are estimated to have over 400 million cords of wood suitable for fuel and fence posts:

Region:	*Pinyon pine-juniper (million cords)*	*Hardwood (million cords)*
Southern Rocky Mountain	284. 5	43. 5
California	37. 4	39. 5
Plains (west of 100th meridian)	3. 7	6. 8
Northern Rocky Mountain	1. 4	8. 8
Pacific Northwest	. 2	. 7
Total	327. 2	99. 3

Large as these volumes are, the timber they represent has such limited use, present and prospectively, that it is not included in national estimates of sawtimber and growing stock.

On nonforest land there is also an additional but unmeasured volume of timber. In this category are the trees in open country along water courses, fence rows, shelterbelts and windbreaks, and highways. Also included is the volume of trees in suburban areas, city parks and streets, orchards, and the volume on scattered timbered plots less than 1 acre in the East or less than 10 acres in the West. Although widely scattered and generally of little value except for fuel, the volume of wood on such areas is unquestionably great. From the viewpoint of meeting the requirements of the forest industries, timber on both the noncommercial forest land and the nonforest land has limited economic significance and is not normally con-

Table 80.—*Net (sound wood) volume of cull trees, salvable dead trees, and hardwood limbs, by section of United States and Coastal Alaska, January 1, 1953*

Class of material	All sections	North	South	West	Coastal Alaska
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*
Cull trees:					
Sound	25. 5	7. 7	16. 2	1. 4	0. 2
Rotten	30. 8	9. 3	8. 2	8. 3	5. 0
Total	56. 3	17. 0	24. 4	9. 7	5. 2
Salvable dead trees:					
Sawtimber [1]	7. 4	. 4	. 2	6. 7	. 1
Poletimber	1. 3	. 2	. 1	1. 0	----------
Total	8. 7	. 6	. 3	7. 7	. 1
Hardwood limbs	23. 3	13. 6	8. 1	1. 6	(2)
Total, all classes	88. 3	31. 2	32. 8	19. 0	5. 3

[1] Including 37 billion board-feet of salvable dead sawtimber.
[2] Less than 50 million cubic feet.

sidered a part of the timber resource available for industrial use.

Ownership of Timber [24]

Slightly more than half of the total sawtimber volume of the United States and Coastal Alaska is on private forest land. The rest is public timber in Federal, State, county, and municipal forest. Of the total forest growing stock, private forests contain a somewhat larger share—nearly three-fifths (fig. 57 and table 81). Slightly more than half of the privately owned sawtimber volume and nearly two-thirds of the privately owned growing stock is in the East. About 90 percent of all the timber in the East—measured either as sawtimber or as growing stock—is on private land. Forest industries and other nonfarm owners have somewhat more than half of the private timber and farm owners somewhat less than half. Public timber in the East is mostly in national forests, although there are sizable State holdings, especially in the North.

[24] A more complete discussion of forest ownership can be found in Ownership of Forest Land and Timber, p. 289.

The West, in sharp contrast to the East, contains more than four-fifths of the Nation's publicly owned timber, both growing stock and sawtimber. Some 40 percent of the western timber is on private land; about 60 percent is on public land. Forest industry and other nonfarm timberlands have most of the private timber; the volume of farm-owned timber in the West is small. National forests contain most of the public timber in the West, while smaller amounts are administered by other Federal agencies and by the States. In Coastal Alaska, nearly all of the timber is in public holdings, chiefly the national forests.

Nationally, the ownership pattern has marked contrasts with respect to tree species (table 82). Private forest lands have nearly 90 percent of the total hardwood sawtimber, but less than 45 percent of the softwoods. National forests now carry slightly more softwood sawtimber than all private forest land. Of the softwood sawtimber on private holdings, forest industries, and other nonfarm owners hold 80 percent. Farm forests have only 20 percent of the privately held softwood, but close to half of all the hardwood sawtimber on private lands.

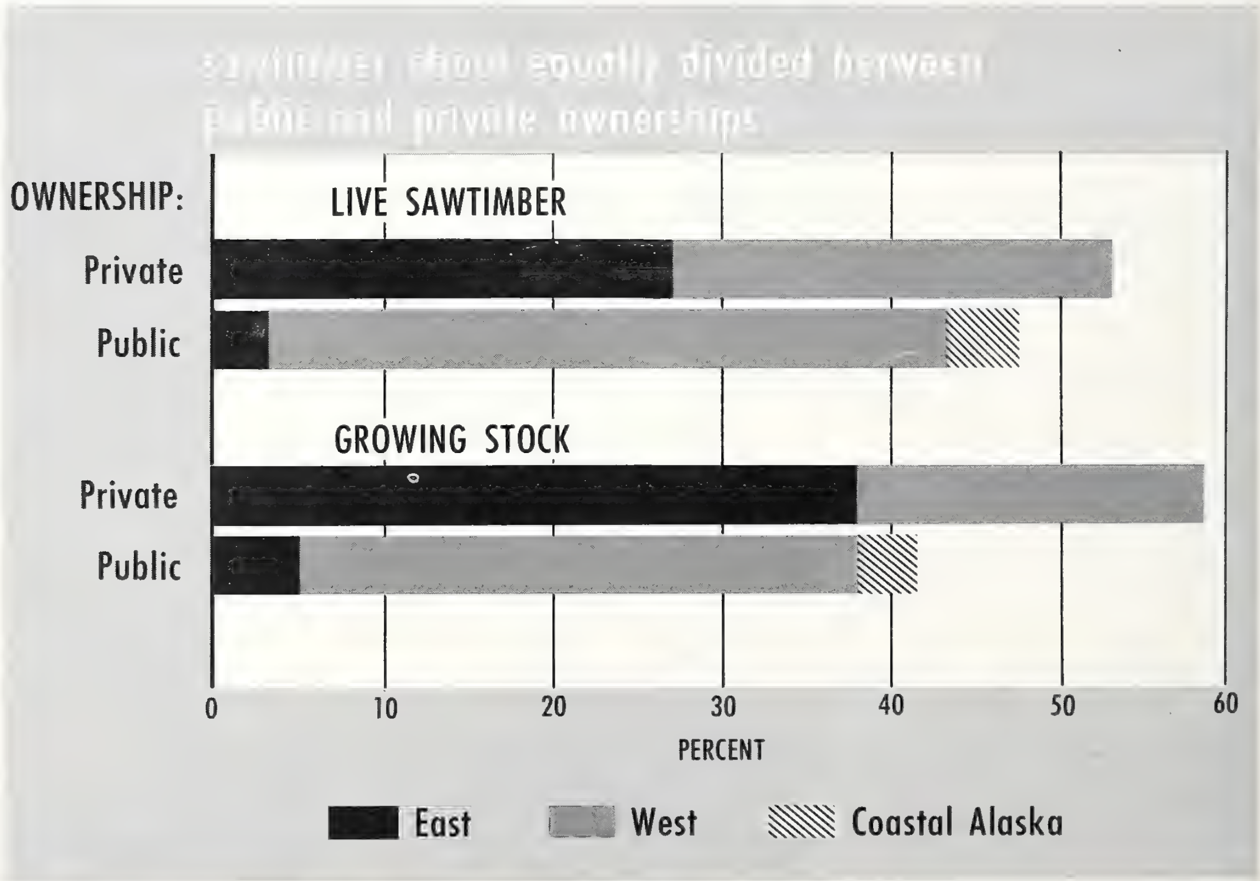


Figure 57

TABLE 81.—*Net volume of live sawtimber and growing stock on commercial forest land in the United States and Coastal Alaska, by ownership class and section, January 1, 1953*

LIVE SAWTIMBER

Ownership class	United States and Coastal Alaska	Coastal Alaska	United States	North	South	West
	Billion bd.-ft.	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*
Private:						
Farm	308		308	102	144	62
Forest industry and other	772	(1)	772	132	178	462
Total	1, 080	(1)	1, 080	234	322	524
Public:						
National forest	766	83	683	13	23	647
Other Federal	135	6	129	4	8	117
State and local	76		76	15	4	57
Total	977	89	888	32	35	821
Total, all ownerships	2, 057	89	1, 968	266	357	1, 345

GROWING STOCK

Ownership class	United States and Coastal Alaska	Coastal Alaska	United States	North	South	West
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*
Private:						
Farm	103		103	39	50	14
Forest industry and other	201	(1)	201	55	54	92
Total	304	(1)	304	94	104	106
Public:						
National forest	163	17	146	6	7	133
Other Federal	28	2	26	2	2	22
State and local	22		22	9	1	12
Total	213	19	194	17	10	167
Total, all ownerships	517	19	498	111	114	273

1 Less than 0.5 billion.

TABLE 82.—*Net volume of live sawtimber on commercial forest land in the United States and Coastal Alaska, by ownership class, January 1, 1953*

Ownership class	All species	Softwood	Hardwood
	Billion bd.-ft.	*Billion bd.-ft.*	*Billion bd.-ft.*
Private:			
Farm	308	140	168
Forest industry and other	772	579	193
Total	1, 080	719	361
Public:			
National forest	766	740	26
Other Federal	135	127	8
State and local	76	62	14
Total	977	929	48
Total, all ownerships	2, 057	1, 648	409

ACCESSIBILITY OF TIMBER

Historically, the lack of ready access to timber has had an adverse effect on the orderly development of the timber supply. Early logging often was concentrated along streams where water transport was feasible. Later, cutting of timber developed along rail lines and more recently along roads. The result has been heavy cutting of the more accessible areas, leaving the more remote timber untouched.

In the East, with few exceptions, accessibility is no longer a major problem. In the West, and principally on public lands in mountainous areas, there is still a problem of accessibility. In such areas, road construction will be costly. Recently, the cost of constructing main timber access roads has exceeded $50,000 per mile on rough topography in Idaho and Montana. In California, the cost may exceed $100,000 per mile for some areas. Lateral roads require an additional outlay.

Three-fifths of the old-growth sawtimber in the West is on national forests, mostly where further development awaits construction of access roads. Only on one-third of this old-growth acreage is 76 percent or more of the allowable cut being harvested. On nearly half of the western national forest old-growth area, the cut being made is less than 50 percent of the harvest allowable under good management (table 83). This lack of cutting in old-growth areas is not entirely a problem of accessibility. Low quality timber, species characteristics, and prices received for timber products are factors just as important as lack of roads in many areas.

Accessibility is gradually being improved. Whereas very few timber access roads were built on western national forests before 1940, and less than 800 miles per year between 1940 and 1951, the annual rate of construction in 1952 was 1,650 miles. In 1956, 2,600 miles were built. The job ahead, though, is still big on national forests alone. At least 30,000 additional miles of new roads are needed for full development and intensive management of the commercial stands of national forest timber, and some 25,000 miles of present roads require improvement or reconstruction.

In Coastal Alaska some progress is being made too; but, though most of the forest lies within a few miles of tidewater, the remoteness of that region continues to be a major obstacle.

Timber Quality [25]

In evaluating timber quality in the past, a common criterion has been stand age. Though little was known about the quality makeup of young-growth timber, it was generally recognized that old-growth stands—composed of the larger slower-growing trees—have quality characteristics that young-growth stands—composed of the smaller, faster-growing trees—do not have. This distinction is still significant. Though the old-growth area is only 10 percent of the total commercial forest area, its heavy stands of timber constitute the major source of high-quality wood today.

Young-growth stands, now occupying 90 percent of the commercial forest land, must be looked to more and more as the old-growth stands are harvested. Hence, the quality of young-growth timber is important. It refers to those properties of wood in the standing tree that affect specific uses; density, growth rate, proportion of spring wood to summer wood, fibril angle (compression wood, tension wood), and the common defects such as knots, shake, and crook.

[25] This section appraises the quality of the present timber supply. Quality is likewise discussed under Growth and Utilization, p. 145; Future Demand for Timber, p. 357; and Timber Supply Outlook, p. 475. In the order named these sections treat the quality of present growth, technological developments which have in part made up for the increasing deficiency in quality timber, and the future quality of domestic timber. Finally, all these considerations are brought together in the summary section, p. 101.

TABLE 83.—*Area of old-growth sawtimber on national forests in the West and Coastal Alaska, by proportion of allowable cut being harvested, 1953*

Region	Total old-growth area	Area [1] on which percentage of allowable cut being harvested is—			
		0–25	26–50	51–75	76–100
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
West:					
Pacific Northwest:					
Douglas-fir subregion	4, 017	430	639	906	2, 042
Pine subregion	6, 115	969	137	1, 829	3, 180
Total	10, 132	1, 399	776	2, 735	5, 222
California	6, 500	1, 997	1, 098	994	2, 411
Northern Rocky Mountain	6, 011	1, 692	2, 355	1, 499	465
Southern Rocky Mountain	5, 567	1, 255	966	1, 012	2, 334
Total	28, 210	6, 343	5, 195	6, 240	10, 432
Coastal Alaska	3, 360	3, 360			
Total, West and Coastal Alaska	31, 570	9, 703	5, 195	6, 240	10, 432
	Percent	*Percent*	*Percent*	*Percent*	*Percent*
Percent	100	31	16	20	33

[1] Based on areas of national-forest working circles.

Because of the diversity of these factors and because their importance varies among the different possible uses of wood, no single measure can describe adequately the quality of the total timber supply. Nevertheless, in recent years, timber and other surveys have been helpful in evaluating the quality of young-growth, in indicating the way quality is changing, and in showing trends in quality requirements.

Quality requirements for timber are of special significance for they tend to place limitations on the utility of the total timber supply. These limitations stem from at least three aspects of timber utilization: product specifications, product costs, and product technology.

Timber product specifications, except for bulk products like pulpwood, chemical wood, and fuelwood, are higher—much higher in some instances—than standards used in the timber inventory. The low-grade saw log in the minimum sawtimber tree, for example, is far too poor for the manufacture of veneer or the upper grades of lumber. Increased outlets for wood as cellulose give added significance to estimates of sound wood, but even in such markets the ratio of cull to sound wood places a limit on what timber can be used. Hence, timber volume estimates often must be discounted to some degree before they become realistic estimates of timber supply.

Costs of logging and processing timber are influenced by tree and stand quality. Limby trees, sparse stands, small trees, and numerous defects all spell high costs for the end product. And with knotty, crooked, or defective logs and bolts, even the most efficient workers equipped with the best machinery cannot be as productive as those handling high-quality timber. While specifications for logs and bolts are often set with regard for the manufacturer's break-even point, few manufacturers can operate for long with no raw materials better than the minimum. To support stable and profitable industries, the timber base must offer a reasonable share of better-than-minimum quality trees and stands. Thus, cost factors tend to limit further the estimates of the timber supply.

Product technology is closely related to quality, too. Where the bulk of the timber is low-grade, economic forces press for advancement in technology. And when such advances take place, usually there is a downward revision in the minimum specifications for quality. The cellulose-based industries are a good example of this effect. While gains in technical knowledge offset low quality to some extent, there is a limit to what technology can do. In many applications, wood is used because it possesses certain intrinsic properties such as high strength-weight ratio, good appearance, or workability. If these properties are missing, it probably will not be used. Thus, if timber is grown without regard for quality in terms of end use, many markets may be lost.

There are many criteria of timber quality, ranging from crude indicators to precise determinations based on the requirements of a specific product or end use. No single, all-inclusive expression of quality is possible, because of the wide variety of products made from wood. The sawtimber-growing stock distinction already mentioned is one crude measure. The prevalence of cull trees, species, and size are also relatively crude indicators of quality in standing timber. Log and tree grades are more reliable in that they predict yields of lumber by grades with relatively good accuracy.

Log Grades Measure Tree Quality

Log grades do not recognize all end-use requirements of timber, but they do reflect some of them indirectly by taking into account diameter, length, and amount and character of defects in individual logs. The objective generally is to express probable yield of lumber, by lumber grade, when the logs are sawed. In the Southeast, for example, a test of over 1,000 pine logs showed that Grade 1 logs yielded 75 percent of their volume in C and Better lumber; Grade 2, 57 percent; Grades 3 and 4 combined, only 12 percent. Thus, the lower the grade of the log the lower the percentage of high-quality lumber.

Log grades have been used to estimate the quality of much of the standing timber in the East. For southern yellow pine, they indicate that the lumber which could be sawed from present stands would be less than one-fifth Grade C and Better, one-fifth would be Number 1 Common, and more than three-fifths would be Number 2 Common or poorer. Much the same situation is shown by the log grade distribution of hardwood sawtimber volume (table 84).

In eastern young-growth timber the high percent of volume in Grade 3 logs has come about gradually and through a number of causes. Fires, disease, and insects have had much to do with the present quality distribution. Economic conditions have favored removal of the high-quality sawtimber and the premature cutting of successively smaller trees. Logging damage to remaining trees has frequently resulted in additional defect. Many of the present young-growth hardwood stands originated as stump sprouts; such sprouts are subject to heart rot and also frequently arise in multiple stems of poor form.

That quality is a continuing problem is indicated not only by the present status but also by successive inventories. In the Lake States, timber inventories by log grades in 1936 and 1953 show

TABLE 84.—*Distribution of live hardwood sawtimber volume in the East, by log grades, 1953* [1]

Region	Grade 1—standard lumber logs	Grade 2—standard lumber logs	Grade 3—standard lumber logs and tie and timber logs	Total, all grades	Volume in areas sampled
	Percent	*Percent*	*Percent*	*Percent*	*Billion bd-ft.*
New England	18	27	55	100	24. 4
Middle Atlantic	20	21	59	100	61. 0
Lake States	13	27	60	100	35. 4
Central	7	11	82	100	53. 6
South Atlantic	24	33	43	100	5. 1
Southeast	10	20	70	100	62. 5
West Gulf	10	19	71	100	45. 1
Weighted average	13	20	67	100	287. 1

[1] The percentage distribution is based on sampling of 75 percent of the hardwood sawtimber volume in the East. In all but the South Atlantic Region, the sampling was well distributed throughout the regions. The South Atlantic sample covers only the southern Coastal Plain counties in North Carolina. The Plains Region was not sampled.

distinct trends in sawtimber volume represented by Grade 1 logs:

	Change from 1936–53 (percent)
Sugar maple	−58
Yellow birch	−84
Basswood	+6
Elm	0
Beech	−80
Oak	+27
Aspen	+187
Soft maple	−59

In the regional estimates for the West, log grades have been used less widely than in other sections. In some places, during the past several years, there has been a gradual decrease in the quality of logs coming into primary manufacturing plants. The decrease is due, chiefly, to two things: logging started in the most accessible and highest quality timber has gradually moved into areas of lesser value; and as stumpage became scarcer and higher priced, more timber of poorer quality was harvested. An example of this situation is apparent in the gradual development of the Douglas-fir subregion. Here, much of the better timber occurred at lower elevations in the Puget Sound, Grays Harbor, and Lower Columbia River areas. As this timber has been cut, logging has moved to higher elevations on the western slopes of the Cascade Range and to southwest Oregon and northern California, where per-acre volumes average less and timber quality is generally lower.

Small Trees Lack Quality

For lumber, veneer, and similar end uses, small size is an important limitation. Many small trees are defect-free and will improve in quality if left to grow. However, the prevalence of small trees, particularly in eastern softwoods, has an important bearing on present supplies and on the future outlook for high-quality timber.

In young-growth timber small trees inevitably make up a high proportion of the sawtimber volume. The result is a high percentage of low-grade logs (table 85). To illustrate, the recent inventory of timber in Alabama showed 88 percent of the southern yellow pine sawtimber volume in trees 18 inches or smaller in diameter, and only 12 percent in 20-inch and larger trees. In the smaller trees less than 1 percent of the volume is in Grade 1 logs and only 11 percent is in Grade 2. The larger trees have 40 percent of their volume in Grades 1 and 2, and 60 percent in Grades 3 and 4. Most of the sawtimber volume in the small trees, 89 percent, is in Grade 3 and 4 logs—not an encouraging situation for industries needing high-quality softwoods.

More than 40 percent of the eastern hardwood sawtimber volume is in trees of the 12- and 14-inch diameter classes. Such trees are too small to contain any Grade 1 standard logs and even medium-sized hardwood trees of the 16- and 18-inch diameter classes seldom carry more than 5 percent of their volume as Grade 1 saw logs. The volume of hardwood trees in the 20-inch and larger diameter classes represents less than 30 percent of the total hardwood sawtimber volume. Even so, the volume in larger trees is relatively greater in hardwoods than in softwoods. This is demonstrated by the following comparison of eastern hardwood and softwood volumes in the 12-inch and larger diameter classes:

	Softwoods (percent)	*Hardwoods (percent)*
12- and 14-inch trees	56	42
16- and 18-inch trees	28	30
20-inch and larger trees	16	28
Total	100	100

Tree size is not yet a major factor in the West and in Coastal Alaska. Softwoods in the 32-inch and larger diameter classes contain about half of

western sawtimber volume (table 86). Redwood, Douglas-fir, sugar pine, and western white pine sawtimber trees, on the average, are bigger than sawtimber trees of other western species. Coastal Alaska has relatively fewer large sawtimber trees than the West, only one-third of the Alaskan sawtimber being in 32-inch and larger trees.

The data point to a continuing decrease in the diameter of the average sawtimber tree. For example, the forest survey in Mississippi showed that between 1935 and 1948 softwood trees of the 20-inch and larger diameter classes decreased 42 percent in number; 12-inch softwood trees numbered only 5 percent less in 1948 than in 1935. Among the Mississippi hardwoods, decreases were substantial in the 16-inch and larger diameter classes. Between the 1936 and 1953 surveys in the Lake States, the proportion of sawtimber volume in 16-inch and smaller trees increased as follows: sugar maple from 44 percent to 61 percent, yellow birch from 36 percent to 55 percent, and white and red pine from 46 percent to 68 percent. In the South Atlantic Region, between the initial survey in the 1930's and 1953, the volume of softwood sawtimber trees 20 inches and larger declined 31 percent, while the volume in hardwood trees in the same size class increased slightly.

In the West, where old-growth provides most of the timber harvest, gradual decreases in average diameter are to be expected. For example, trees of the 42-inch and larger diameter classes accounted for 55 percent of Douglas-fir sawtimber volume in western Washington in 1933; by 1953 these larger trees represented only 45 percent of the total. Thus, even in the young-growth forests of the East as well as in the old-growth forests of the West the size of the average trees is declining and the problems relating to quality increase accordingly.

TABLE 85.—*Distribution of live sawtimber volume in the East, by species group and tree-diameter class, January 1, 1953*

Species	Total	Diameter class (inches)[1]			
		10	12 and 14	16 and 18	20 and larger
	Percent	*Percent*	*Percent*	*Percent*	*Percent*
Softwoods:					
Southern yellow pine	100	24	44	22	10
Other softwoods	100	22	38	21	19
Total, or average	100	24	43	21	12
Hardwoods:					
Oak	100	-----	41	29	30
Gum and yellow-poplar	100	-----	44	33	23
Yellow birch and sugar maple	100	-----	37	30	33
Other hardwoods	100	-----	44	29	27
Total, or average	100	-----	42	30	28
Total all species	100	9	42	27	22

[1] The estimates of sawtimber volume include the volume in softwood trees of the 10-inch diameter class but do not include hardwood trees of that class.

TABLE 86.—*Distribution of live softwood sawtimber volumes in the West and Coastal Alaska, by species group and tree-diameter class, January 1, 1953*

Species	Diameter class (inches)			Total
	12–20	22–30	32 and larger	
	Percent	*Percent*	*Percent*	*Percent*
Douglas-fir	18	23	59	100
Ponderosa pine and Jeffrey pine	20	36	44	100
Sugar pine and western white pine	21	20	59	100
Other western softwood	28	29	43	100
All softwood	23	27	50	100

Cull Trees Numerous

Eastern hardwood stands have a large overburden of cull trees, many of them holdovers from previous cuttings. The sound wood in these trees is equivalent to one-fourth of the entire hardwood growing stock. In the South alone, the net volume of hardwood cull trees exceeds one-third of the hardwood growing stock. And, of all sound hardwood volume in the East, some 18 percent [26] is in cull trees:

Region	*Hardwood cull-tree volume as proportion of—*	
	Growing stock (percent)	*All-timber volume (percent)*
North:		
New England	22	17
Middle Atlantic	14	11
Lake States	16	13
Central	20	13
Plains	22	14
Average	18	13
South:		
South Atlantic	29	20
Southeast	42	27
West Gulf	31	21
Average	34	23
Total East, average	25	18

[26] These percentages are not equivalent to "cull percent," since the latter includes the sizable volume of sound but defective material in growing-stock trees.

Cull trees take up growing space and thus reduce the productivity of the forest land. Because rotten culls contain proportionately less sound wood than growing stock trees, their net volumes understate the growing space that cull trees occupy. For example, in the Southeast and West Gulf regions, cull trees account for more than one-fifth of the total basal area of all trees in the 6-inch and larger diameter classes. About every fifth tree of sawtimber size in the Central Region is a cull. In New England, where hardwood culls make up 17 percent of live-tree net volume, they represent more than 22 percent of the gross volume.

The inventory of cull hardwood in the East has been gradually changing. In some regions, stand quality has been raised by the expanding use of low-quality hardwood trees for pulp-making. In the Southeast, where successive estimates are available, stand deterioration seems to be continuing. Here, the original surveys found 77 percent of the total sound hardwood volume in growing stock trees and 23 percent in cull trees. By 1953 the sound-wood proportion in growing stock trees had dropped to 71 percent and the cull-tree percentage had climbed to 29. Heavy cutting of the better trees had reduced the level of growing stock. Left to grow, the cull trees increased in volume.

Compared to hardwood, cull trees of softwood species occupy a small proportion of softwood stands. In the West, 3 percent of the total sound volume of softwood is in cull trees; in the East, cull trees account for 5 percent of the sound softwood volume. Only in Coastal Alaska are the softwood forests characterized by a large volume in cull trees—some 22 percent of the total sound volume in that region. However, in all regions the sound wood volume of softwood growing stock includes much material that is unsuited for saw-log use because of small size or poor form.

Better Quality Species Diminishing

Composition of timber volume by species and distribution of area by forest types are not exact criteria of stand quality, but for most end uses some species and types are generally considered more desirable than others. The available evidence shows that the more aggressive but less desirable species are tending to displace preferred species in both the East and the West.

In the East, many of the young-growth forest types are not especially stable. As a result of disturbance due to cutting, fire, grazing, or insect and disease infestations, some species are favored and the type tends to change. Even without disturbance of any kind, most young-growth types tend to change with time as short-lived species die out and as conditions for regeneration are altered. For example, in the South the leading softwood type, loblolly-shortleaf pine, has been expanding at the expense of the longleaf-slash pine. In turn, the more aggressive hardwood types, as a result of continued fire protection, are replacing loblolly-shortleaf pine in some areas.

Because of fire, cutting, hardwood competition, and lack of seed sources, white pine, once the prominent forest type in the Lake States, has been reduced to about a million acres. The aspen-birch type has come in instead. In the young-growth spruce-fir stands of the Northeast, hardwoods tend to supplant softwood. The net effect of these shifts has been a gradual reduction in the eastern softwood acreage and an increase in hardwood acreage. The shifts will be even more noticeable in the future as young growth matures.

The relationships between species composition and timber quality are also apparent in the East. Wherever resurveys of large forest areas have been made they have shown that the proportion of better quality species in the sawtimber volume inventory has generally decreased, while the proportion of poorer quality species has increased. They bear out the general observation that cuttings that are concentrated on preferred species or high-quality trees often lower stand quality, because more of the area is taken over by the less desirable species that remain, or sprout, or seed-in.

Type and species changes are also taking place in the West. Lodgepole pine has formed dense stands following fire in some other softwood types. Through cutting of white pine and not the associated species, other softwoods now predominate on many former white pine areas in the Northern Rocky Mountain Region. Because of blister rust, some white pine stands have also been giving way to fir and larch. In local areas in the Pacific Northwest, as the Douglas-fir type passes maturity western hemlock invades and appears in great abundance. Ponderosa pine, a preferred species, has lost ground to white fir, which in the West is exceptionally aggressive following logging.

These are only a few examples of changes in forest types and species composition that could be cited to show declines in stand quality and losses of potential productivity of the forest site. Changes that indicate improvement in stand quality are less numerous—probably because most such changes take place very slowly. Although it is difficult to appraise the magnitude of such changes, it is apparent in both the East and the West that the more aggressive but less desirable species are tending to displace preferred species.

Trends in Timber Volume

From time to time since 1895, estimates have been made of the volume of standing timber in the United States. Occasionally, a series of estimates, such as the following, have been pre-

sented as evidence of past trends in the Nation's timber supply:

Year	Volume estimate (billion bd.-ft.)	Year	Volume estimate (billion bd.-ft.)
1895 [1]	2, 300	1930 [7]	1, 668
1902 [2]	2, 000	1938 [8]	1, 764
1905 [3]	1, 970	1945 [9]	1, 621
1908 [4]	2, 500	1945 [10]	1, 601
1909 [5]	2, 826	1953	1, 968
1920 [6]	2, 215		

[1] Fernow, B. E. *Facts and Figures Regarding Our Forest Resources Briefly Stated.* U. S. Dept. Agr., Div. Forestry Cir. 11, 8 pp. 1896.

[2] ———. *Economics of Forestry.* 520 pp. 1902. New York.

[3] Defebaugh, J. E. *History of the Lumber Industry of America.* 2 v. 1906–07. Chicago.

[4] Kellogg, R. S. *The Timber Supply of the United States.* U. S. Dept. Agr. Forest Serv. Cir. 166, 24 pp., illus. 1909.

[5] U. S. Dept. Commerce and Labor, Bur. Corps. *Summary of Report of the Commissioner of Corporations on the Lumber Industry. Pt. I, Standing Timber.* 38 pp., illus. 1911.

[6] U. S. Forest Serv. *Timber Depletion, Lumber Prices, Lumber Exports, and Concentration of Timber Ownership.* Ed. 2. Rpt. on Sen. Res. 311, 66th Cong., 2d Sess. 73 pp., illus. (Capper Rpt.) 1920.

[7] ———. *A National Plan for American Forestry.* Sen. Doc. 12, 73rd Cong., 1st Sess. 2 v., 1,677 pp., illus. (Copeland Rpt.) 1933.

[8] Cong. U. S., Joint Committee on Forestry. *Forest Lands of the United States.* Sen. Doc. 32. 77th Cong., 1st Sess. 44 pp., illus. (Joint Congressional Committee Rpt.) 1941.

[9] Woods, J. B. *Report of the Forest Resource Appraisal.* Amer. Forests 52: 413–28. 1946.

[10] U. S. Dept. Agr. Forest Serv. *Forests and National Prosperity.* Misc. Pub. 668, 99 pp., illus. 1948. (Reappraisal Rpt.)

While trends may seem apparent, all of the published estimates of sawtimber volume actually lack direct comparability. However, since 1928, when a national forest survey was authorized by Congress, the measurement of timber volume by board-foot and cubic-foot units has been extended to many forest regions. Each subsequent national estimate has been based more and more upon this forest survey.

The reasons for lack of comparability are many and complex. Briefly, though, they may be summarized as follows: As efforts have progressed to measure accurately the timber supply, utilization standards have changed, so that the sawtimber and growing stock volumes based on these standards have changed too. For sawtimber trees, the earlier studies used higher diameter limits than the more recent studies. Likewise, the percent of defect permitted in merchantable timber is higher now than formerly, and some species once considered as noncommercial are now included in the commercial group. These and other changes in utilization standards have a most significant bearing on the comparability of periodic timber volume estimates.

Another factor has been the changing definition as to what constitutes forest land. Consequently, at times, estimates of the commercial forest area have increased, and at other times they have decreased, thus changing the estimate of the supply of merchantable timber. Changes in land use as the result of land clearing or abandonment are involved too in determining timber volume.

Improvement in timber inventory procedures has also been a factor. Use of more accurate base maps, of aerial photographs, and of scientific sampling methods revealed inadequacies of older estimates and the danger of comparing them.

Finally, the progress of the national Forest Survey since 1930 has been a major factor in refining the successive estimates. As each periodic appraisal was made in 1938, 1945, and 1953, the forest area covered by the national survey project has increased. Thus, the published reports inevitably lack comparability.

Data Adjusted for Comparability

Taking into account, to the extent possible, the factors noted above, the 1945 data in published reports were adjusted to bring the estimates into accord with 1953 standards. The method of adjustment varied between States, depending upon the Forest Survey and other data available. The adjustments were admittedly crude for the 30 percent of the commercial forest area where Forest Survey data were weakest. Elsewhere it is believed that the Forest Survey provided a reasonably good basis for adjusting or reconstructing the 1945 estimate through providing for major area changes, lowering the diameter limit for sawtimber, interpolating between original survey and resurvey data where possible, projecting backward 1953 data using growth rates and estimated annual cut, and using what other data subsequently became available.

Apparent Overall Changes Show No Discernible Trends

The comparison of adjusted figures for 1945 with the 1953 estimates suggest the possibility that the total growing stock volume has increased about 2 percent in the eight-year period, whereas the volume of sawtimber has declined about 2 percent (table 87). However, it would be inappropriate to draw any definite conclusions from

TABLE 87.—*Trends in timber volume for continental United States, 1945–1953*

GROWING STOCK

Species group	1945, as published [1]	1945, adjusted	1953	Apparent change, 1945–53
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Percent*
Eastern hardwoods	147	129	151	17
Eastern softwoods	84	74	74	-------
Western species	239	287	274	−5
Total	470	490	499	2

SAWTIMBER VOLUME

Species group	1945, as published [1]	1945, adjusted	1953	Apparent change, 1945–53
	Billion bd.-ft.	*Billion bd.-ft.*	*Billion bd.-ft.*	*Percent*
Eastern hardwoods	299	351	381	9
Eastern softwoods	260	247	242	−2
Western species	1, 042	1, 408	1, 345	−5
Total	1, 601	2, 006	1, 968	−2

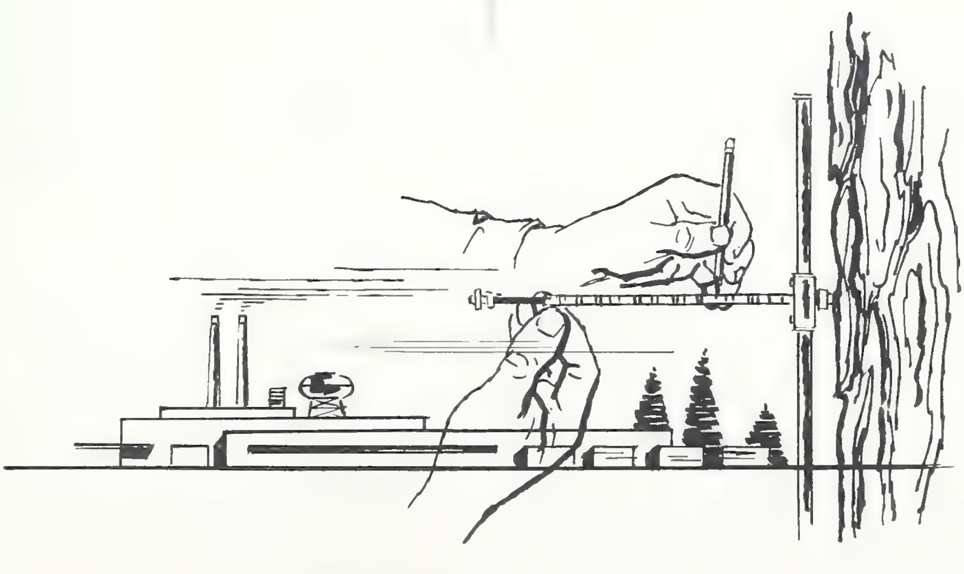
[1] U. S. Forest Service. *Gaging the Timber Resource of the U. S.*, Rpt. 1 from a Reappraisal of the Forest Situation, 62 pp., illus. 1946.

these results because sampling errors associated with the 1953 estimate or possible inaccuracies in deriving the adjusted 1945 figure would, in all probability, tend to nullify the significance of any such small overall changes.

It is believed that more reliance can be placed on the volume changes indicated for broad species groups, particularly eastern hardwoods and western species. Perhaps most significant is the apparent increase in eastern hardwoods—a 17-percent gain in growing stock and a 9-percent gain in sawtimber. The apparent decline in western species amounted to 5 percent for both growing stock and sawtimber since 1945. While the actual amount of change may be somewhat more or less in either instance, for the reason noted in the preceding paragraph, it nevertheless seems highly probable that the trends are correctly indicated.

To the extent that the apparent increase in eastern hardwoods has resulted in displacement of the already scarce softwoods, additional hardwood volume may be an undesirable trend. The decline in the volume of western species reflects a logical trend that may not be arrested until such time as more second-growth timber gains in volume and area and replaces present old-growth sawtimber stands. Eastern softwoods appear to have leveled off in both growing stock and sawtimber.

Growth and Utilization



CONTENTS

GROWTH AND UTILIZATION [27]

George F. Burks
C. Edward Behre [27a]

Essential to an appraisal of the timber situation is information on annual timber growth, mortality, amount cut and used, and the volume cut but left unused in woods and mills. In the long run, our timber needs can only be met by growing as much timber of desired species, size, and quality as will be required. A comparison of annual timber growth and cut gives one measure of the adequacy of current timber growth. Analysis of cut in recent years provides a starting point for estimating the size of needed future timber crops. Knowledge of present losses from fire, insects, disease, and other causes gives some indication of the extent to which better protection and management may augment the available timber supply in future years. And study of unused woods and plant residues challenges technological progress to make the timber we cut go further.

This section presents the available data on current annual growth. It summarizes information on mortality, the nature, causes, effects, and control of which are discussed in the section on Forest Protection. It analyzes timber products output in 1952, and translates this output into the amount of growing stock cut or killed in logging. It then compares timber cut and growth in 1952. Logging and plant residues are analyzed to show their quantity, character, and source, and to ascertain the extent to which they are being utilized. Finally, trends in timber utilization are appraised to throw light on possibilities for better and more complete use of growing stock, greater use of cull and dead trees, reduction of plant residues, and better and more complete use of them.

Pertinent to the analysis throughout is the role of sawtimber in the Nation's timber economy. Currently, about 84 percent of the timber cut is from sawtimber, and there are strong indications that sawtimber will continue to play about the same relative role in our timber-product needs of the future. Therefore, sawtimber is more prominently featured in the discussion of the growth and utilization characteristics of the timber situation than is growing stock.

The United States is passing from the era in which its needs for timber products could be met by cutting the abundant supply of virgin timber. We now know that timber for future needs must be grown as an annual crop from the soil. Since timber crops require years to mature, we must take steps now to assure ample future supplies.

ANNUAL TIMBER GROWTH AND MORTALITY

Annual Timber Growth

As with any other crop, the timber that can be harvested year after year is limited by the amount that is grown each year. But with trees, the harvest in any year does not consist of the timber grown that year. It consists of the accumulated growth of many years in the trees that are cut. So, if we are to have a dependable harvest, we must develop and sustain a stock of standing timber in a succession of age classes which will permit the cut to be taken each year in trees of the needed sizes and which, in the aggregate, will have sufficient net annual growth to offset the needed cut.

In the following discussion, annual growth means the net change in volume of timber for a specified year from causes other than cutting. It includes growth of the timber on hand at the beginning of the year, plus the total volume of young timber reaching poletimber or sawtimber size during the year (commonly referred to as ingrowth), minus the mortality occurring during the year.

As used in this report, annual growth differs from growth as defined in the 1945 Reappraisal project in that it is net growth [28] exclusive of losses from fire, disease, insects, and other causes. On the Reappraisal project, all losses from fire.

[27] The text and included tables deal chiefly with regional, sectional, and national data. More detailed statistics, including data for individual States, are presented in the appendix, p. 499.

[27a] Mr. Behre retired Oct. 1, 1955.

[28] For those interested in determining gross growth, it can be derived by combining net growth and mortality estimates presented in the following tables or from tables presented in the appendix.

epidemic losses from insects and disease, and abnormal losses from other causes were not deducted from growth, but were included as part of the drain.[29]

The South Leads in Annual Timber Growth

Annual growth of sawtimber in 1952 totaled 47.4 billion board-feet for the United States and Coastal Alaska. The corresponding growth for growing stock was 14.2 billion cubic feet (table 88).

About half of the growth of both sawtimber and growing stock occurs in the South, which has only 40 percent of the commercial forest land. The West has 24 percent of the sawtimber growth and almost the same proportion of the commercial forest land. Its share of growing-stock growth, however, is only 19 percent. The North, with 36 percent of the commercial forest land, has only 25 percent of the sawtimber growth and 33 percent of the growing-stock growth. Growth in the West still tends to be held down by the large residuum of virgin timber, which has little net growth. In the East, annual growth reflects the adverse results of past treatment. In their present rundown condition, eastern forests are producing much less than they are capable of.

Softwoods, generally more desirable than hardwoods, account for 59 percent of the sawtimber growth, but only 49 percent of the growing-stock growth. The larger proportion in sawtimber growth is related primarily to the fact that the minimum size of sawtimber trees in the North and South is lower for softwoods than for hardwoods. It is worth noting that hardwoods account for four-fifths of the sawtimber growth in the North and two-fifths in the South (fig. 58). For the reason already stated, hardwoods account for still larger proportions of the growth of growing stock.

The dominant position of the South is due to its lead in softwood growth; it falls a little below the North in hardwood growth. The proportions for softwood sawtimber growth are South, 52 percent; West, 39 percent; North, 9 percent. For hardwood sawtimber, the distribution is North, 50 percent; South, 49 percent; West, 1 percent. The distribution of growing-stock growth is generally similar, but for both softwoods and hardwoods the

[29] In addition to losses from fire, epidemics of insects or disease, and other destructive agents, forest drain as reported in the 1945 Reappraisal included commodity drain or the amount of forest growing stock cut for various products, including the volume knocked down or otherwise killed in logging and left unused in the woods. Thus, commodity drain in the Reappraisal report is equivalent to timber cut in this report. No term comparable to forest drain or total drain, as used in the Reappraisal report, appears in this report.

TABLE 88.—*Net annual timber growth in the United States and Coastal Alaska, by section and region, 1952* [1]

Section and region	Growing stock			Live sawtimber		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
North:						
New England	878	291	587	1, 857	914	943
Middle Atlantic	1, 357	156	1, 201	3, 160	470	2, 690
Lake States	1, 180	319	861	2, 693	802	1, 891
Central	1, 128	46	1, 082	3, 963	249	3, 714
Plains	116	9	107	401	40	361
Total	4, 659	821	3, 838	12, 074	2, 475	9, 599
South:						
South Atlantic	1, 908	969	939	6, 880	3, 670	3, 210
Southeast	3, 056	1, 714	1, 342	10, 035	6, 679	3, 356
West Gulf	1, 843	881	962	7, 102	4, 146	2, 956
Total	6, 807	3, 564	3, 243	24, 017	14, 495	9, 522
West:						
Pacific Northwest:						
Douglas-fir subregion	998	943	55	5, 149	5, 010	139
Pine subregion	329	329	(2)	828	824	4
Total	1, 327	1, 272	55	5, 977	5, 834	143
California	595	539	56	2, 939	2, 895	44
Northern Rocky Mountains	603	591	12	1, 534	1, 508	26
Southern Rocky Mountains	220	194	26	728	677	51
Total	2, 745	2, 596	149	11, 178	10, 914	264
Total, United States	14, 211	6, 981	7, 230	47, 269	27, 884	19, 385
Coastal Alaska	32	32	(2)	128	127	1
United States and Coastal Alaska	14, 243	7, 013	7, 230	47, 397	28, 011	19, 386

[1] Statistics by States are shown in appendix table 12. [2] Less than 0.5 million.

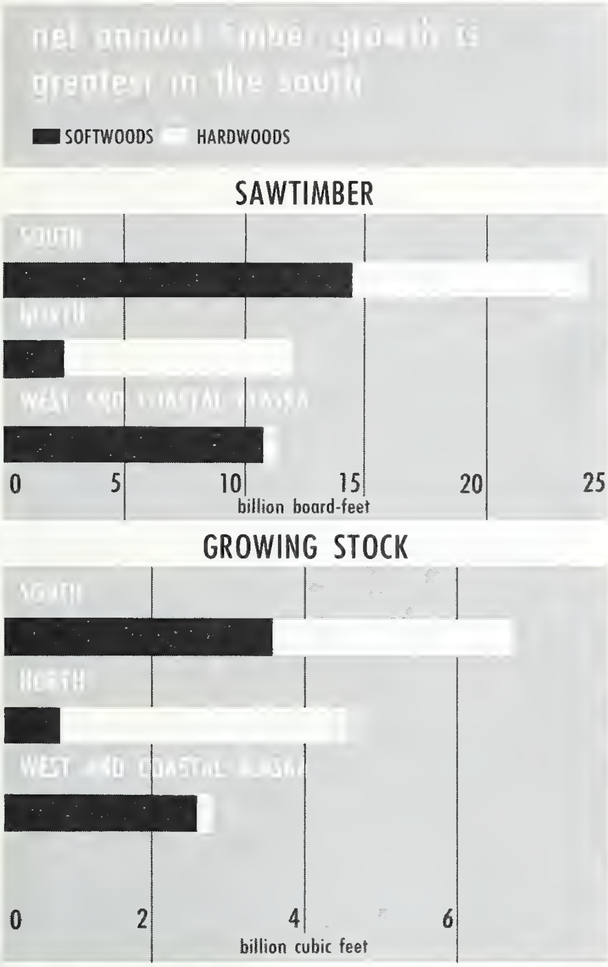


Figure 58

North has a somewhat larger percentage than it has in sawtimber.

Rates of sawtimber growth (growth as a percentage of timber volume) are also highest in the South:

	All species (percent)	*Softwood (percent)*	*Hardwood (percent)*
North	4.5	4.2	4.6
South	6.7	7.9	5.5
West and Coastal Alaska	.8	.8	.9

It is well known that the most important softwoods are rapidly growing species. However, the present extremely high growth percent for sawtimber softwoods in the South is partly due to the predominance of young growth in southern softwood forests and the resulting high proportion of trees just attaining minimum sawtimber size. The generally more favorable growing conditions in the South probably account for the higher growth rates for hardwoods in that section in comparison with the North.

The western softwood growth rate is low because of the old-growth timber, which provides a large base but contributes little to net annual growth. Some important western species, however, are inherently fast growing in early life. Among these are western hemlock, redwood, and Douglas-fir.

Southern Yellow Pine Dominates Annual Growth

The southern yellow pines, as a group, account for 30 percent of the entire country's sawtimber growth (fig. 59). The growth of the southern yellow pines is slightly greater than that of all other softwoods combined.

Eastern softwood sawtimber growth is 83 percent southern yellow pine (table 89). This preponderance reflects the favorable conditions for

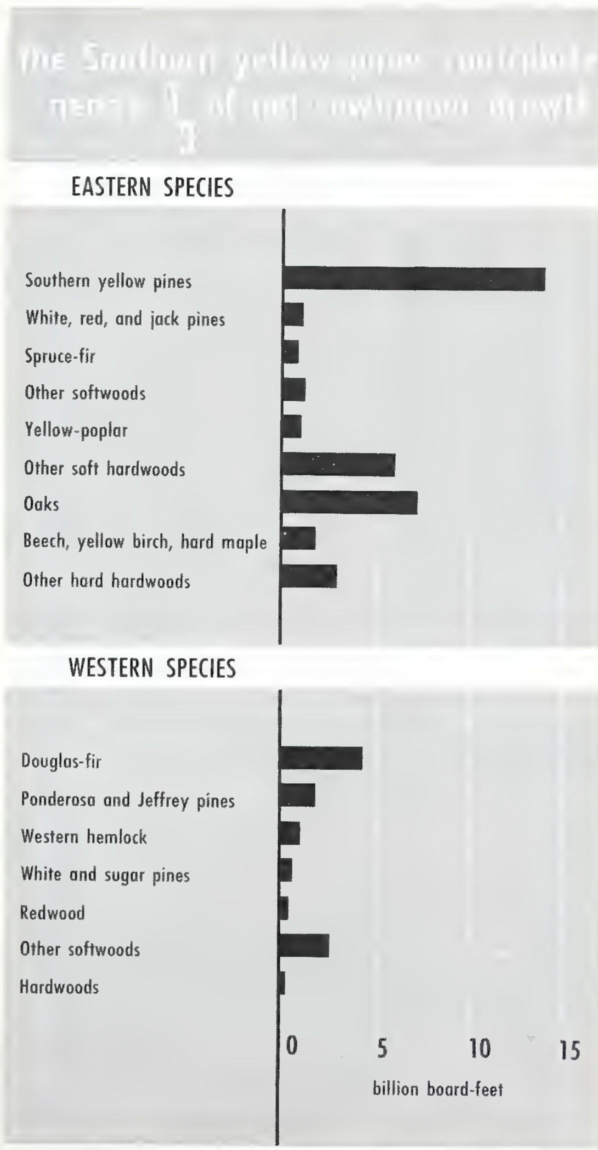


Figure 59

includes Coastal Alaska

establishment of pine which prevailed as wildfires were held in check by the spread of organized protection over the huge area of forest land in the South. In contrast, establishment and growth of softwoods on the smaller acreage of suitable land in the North has been impeded by the presence and dominance of hardwoods. White pine, the most important softwood in the North, dominated the timber economy of an earlier period. Yet white, red, and jack pines, as a group, have only 5 percent of eastern softwood growth at present. Similarly, spruce and balsam fir, for years the backbone of the woodpulp industry, have only 4 percent of eastern softwood growth. All other softwoods, chiefly hemlock and cypress, make up the remaining 7 percent.

The Oaks Dominate Eastern Hardwood Growth

The oaks as a group contribute three-eighths of eastern hardwood growth and comprise about an equal proportion of the total hardwood sawtimber volume. On the basis of this volume-growth relationship, it is estimated that the more valuable white and red oaks [30] contribute 45 percent of all oak sawtimber growth and the less desirable oaks 55 percent.

Beech, yellow birch, and sugar maple, generally valuable for manufacture, account for only 10 percent of eastern hardwood growth. In this group, however, beech—which comprises almost one-third of the group's sawtimber volume—is distinctly less valuable than the other species.

Yellow-poplar, one of the most valuable hardwoods, makes up only 5 percent of the hardwood growth. To be sure, it is a rapidly growing species, but it comprises only 4 percent of the hardwood timber volume.

Thus the five most desirable hardwoods—white oak, red oak, yellow birch, sugar maple, and yellow-poplar—account for less than 30 percent of all eastern hardwood growth. If other soft hardwoods, increasingly used for pulpwood, are added, the total is still less than 60 percent. This leaves more than 40 percent for the less desirable species.

TABLE 89.—*Net annual growth of eastern species in the United States, by species group, 1952* [1]

Species group [2]	Growing stock	Live sawtimber
	Million cu. ft.	*Million bd.-ft.*
Softwoods:		
White, red, and jack pine	270	906
Southern yellow pine	3, 483	14, 155
Spruce-fir	291	742
Other softwoods	341	1, 167
All softwoods	4, 385	16, 970
Hardwoods:		
Yellow-poplar	289	948
Other soft hardwoods	2, 290	6, 041
Total	2, 579	6, 989
Oak	2, 478	7, 316
Beech-yellow birch-sugar maple	718	1, 877
Other hard hardwoods	1, 306	2, 939
Total	4, 502	12, 132
All hardwoods	7, 081	19, 121
All species	11, 466	36, 091

[1] Net annual growth by species groups and regions is shown in tables 101 and 102 in this section, and in the Basic Statistics, tables 33 and 35 of the appendix.

[2] Reference to the more important species in other softwoods, other soft hardwoods, and other hard hardwoods is found on p. 158.

Douglas-Fir Dominates Annual Growth in the West

Douglas-fir, the country's most widely used species, contributes 39 percent of all the sawtimber growth of the West and Coastal Alaska (table 90 and fig. 59). Two-thirds of this is in the Douglas-fir subregion of Oregon and Washington, where the bulk of the Douglas-fir timber is concentrated.

Ponderosa and Jeffrey pines, the former important in every western region, account for 16 percent of western sawtimber growth.

Western hemlock, very largely in the Douglas-fir subregion and Coastal Alaska, is next in line with 9 percent.

The high-priced specialty woods are of relatively limited occurrence and do not loom large in western annual growth: White and sugar pines have 5 percent, and redwood (all in California) 4 percent.

Other softwoods comprise 25 percent of western sawtimber growth and 30 percent of growing-stock growth. This differential in growing-stock growth points toward an eventual higher proportion of these generally less desirable species in the sawtimber stand.

The growth of western hardwoods, although only 2 percent for sawtimber, comprises 5 percent of all western growing-stock growth.

[30] White oak (*Quercus alba*), chestnut oak (*Q. prinus*), cherrybark oak (*Q. falcata* var. *pagodaefolia*), and Shumard oak (*Q. shumardii*).

TABLE 90.—*Net annual growth of western species in the United States and Coastal Alaska, by species group, 1952* [1]

Species group [2]	Growing stock	Live sawtimber
	Million cu. ft.	*Million bd.-ft.*
Softwoods:		
Douglas-fir	902	4,431
Ponderosa and Jeffrey pine	[3] 479	[4] 1,841
Western hemlock	237	1,038
White and sugar pine	100	535
Redwood	77	396
Other softwoods	833	2,800
All softwoods	2,628	11,041
Hardwoods	149	265
All species	2,777	11,306

[1] Net annual growth by species groups and regions is shown in table 103 in this section (p. 167), and int he Basic Statistics, tables 34 and 36 of the appendix.

[2] Reference to the more important species in other softwoods is found on p. 160.

[3] Excludes 4 million cubic feet of ponderosa pine in the Plains Region. The total net annual growth of ponderosa and Jeffrey pine in the United States is 483 million cubic feet.

[4] Excludes 16 million board-feet of net growth of ponderosa pine in the Plains Region. The total net annual growth of ponderosa and Jeffrey pine in the United States is 1,857 million board-feet.

Annual Growth Is Increasing

The first published estimate of annual timber growth in the United States appeared in 1920. Revised estimates were made for subsequent reports on the national timber situation as of 1930, 1936, and 1944:

		Annual growth	
Date:	Report:[1]	Billion bd.-ft.	Billion cu. ft.
1920	Capper	9.7	6.0
1930	Copeland	11.7	8.9
1938	Joint Congressional Committee.	32.0	11.3
1944	Reappraisal	35.3	13.4
1952	Timber Resource Review	47.3	14.2

[1] For references see section on Forest Land and Timber, page 113.

For various reasons, these periodic estimates of timber growth are not comparable. Changing utilization standards, differing definitions as to what constitutes forest land, and improvement in timber inventory procedures, which have affected periodic estimates of timber volume,[31] have likewise affected estimates of timber growth. In addition, there were changes in standards and techniques applying strictly to growth that were reflected in estimates made at different times. In some cases, the change has been toward an apparent increase and, in others, toward an apparent decrease in timber growth.

[31] See discussion in the section on Forest Land and Timber, p. 113.

Factors tending to exaggerate the increase of annual growth that was probably taking place include the decrease in the lower limit of sawtimber size in one region after another; the increase in allowable percentage of defect; and the inclusion of species formerly omitted and scattered stands of sawtimber and much pole timber formerly overlooked. In addition to these factors, the crude estimate in the Capper Report of 1920 included only the growth on existing stands and took no account of the "ingrowth" of timber added to growing stock during the year of estimate. Working in the opposite direction is the change in the present report to net growth after allowing for all mortality from fire, insects, disease, and other causes.

Data Adjusted for Comparability

Progress of the Forest Survey in recent years, including resurvey of much of the area previously surveyed and improved techniques of timber inventory and growth calculation, provided a reasonably good basis for adjusting or reconstructing the 1944 estimates to bring them into accord with 1952 standards. The method of adjustment varied depending upon the Forest Survey and other data available. Generally the adjustments involved (1) deriving 1944 growth rates either through adapting the 1952 rates corrected for changes in mortality 1944 over 1952 or by interpolation of growth rates between successive surveys bracketing 1944, and (2) the application of the 1944 rates so derived to adjusted 1944 timber volumes or conversion of these rates to growth per acre and applying them to the 1944 adjusted acreage by stand-size classes.

Apparent Overall Changes Indicate Favorable Trends

The comparison of adjusted figures for 1944 and 1952 provides reasonably strong evidence that sawtimber and growing-stock growth has increased (table 91). The indications are that overall sawtimber growth has increased 9 percent and total growing-stock growth 14 percent. Whether these differences represent the actual amount of change cannot be proved because of the possibility of bias in deriving the adjusted 1944 figure and sampling errors associated with the 1952 estimate. Nevertheless it seems unlikely that the error of estimate from whatever cause would be great enough to affect the validity of the indicated trends significantly.

Perhaps even more encouraging is the apparent increase in the growth of eastern species—for hardwoods a 20-percent gain in growing stock and 16-percent gain in sawtimber, and for softwoods a 16-percent gain in growing stock and an 11-percent

TABLE 91.—*Trends in net annual growth for the United States, 1944–52*

GROWING STOCK

Species group	1944, as published [1]	1944, adjusted [2]	1952	Apparent change, 1944–52
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Percent*
Eastern hardwoods	5.89	5.89	7.08	+20
Eastern softwoods	3.94	3.78	4.39	+16
Western species	2.06	2.79	2.74	−2
Total	11.89	12.46	14.21	+14

SAWTIMBER

Species group	1944, as published [1]	1944, adjusted [2]	1952	Apparent change, 1944–52
	Billion bd.-ft.	*Billion bd.-ft.*	*Billion bd.-ft.*	*Percent*
Eastern hardwoods	12.08	16.53	19.12	+16
Eastern softwoods	13.17	15.25	16.97	+11
Western species	5.81	11.57	11.18	−3
Total	31.06	43.35	47.27	+9

[1] U. S. Forest Service. *Gaging the Timber Resource of the U. S.* Rpt. 1 from a Reappraisal of the Forest Situation, 62 pp., illus. 1946. Published figures of gross growth were converted to net growth for purposes of comparison with adjusted 1944 and 1952 estimates by deducting all mortality from fire, insects, disease, and other natural causes.

[2] Adjusted to bring estimates into accord with 1952 standards.

gain in sawtimber. The greater relative increase in growing stock is especially significant because it reflects the spread and improvement of organized protection from fire.

With respect to western species, the comparison suggests the possibility that the growth of both growing stock and sawtimber has declined slightly. However, definite conclusions in this regard are not justified because the error of estimate might, in all probability, be such as to nullify the significance of changes as small as 2 or 3 percent.

Growth should increase in the West to the extent that the old-growth stands are cut and replaced by more vigorous second growth. However, premature cutting of second growth can offset this increase, and this is apparently happening on small, private ownerships in the Pacific Northwest. A major factor tending to hold down growth in the West in 1952 was the severe outbreak of bark beetles in the Northern Rocky Mountain Region.

Quality of Present Growth Is Declining

There is little quantitative information on which to appraise the quality of present growth. Generally speaking, if small sawtimber trees make up the greatest share of sawtimber volume, the largest share of the growth will likewise occur on small trees. In the East, for example, about 40 percent of the hardwood sawtimber volume and nearly 70 percent of the softwood sawtimber volume is in trees of 15 inches and less. It might logically be assumed, therefore, that from 40 to 70 percent of the sawtimber growth of eastern species is on trees too small to yield high-quality logs. To get high-grade logs, it is necessary to delay cutting the well-formed trees until they are 16 to 18 inches in diameter or larger.

Log grades which provide a measure of stand quality likewise provide an indication of quality growth. About two-thirds of the hardwood sawtimber volume in the East, for example, is in Grade 3 or poorer logs. While most of this volume is in small trees that would gain in quality if left to grow to larger sizes, some of it is in larger trees too poor to put on quality growth. Thus, from a quality standpoint, whatever growth is added to this share of the volume is largely ineffective.

On the whole, about one-third of the growth of eastern hardwoods is believed to be in high-quality logs. However, in Indiana, Kentucky, and Ohio, it has been found that the percentage of net sawtimber growth in high-quality logs ranges from 14 to not more than 20 percent. In the Lake States, between 1936 and 1953, the total volume of hardwood sawtimber in Grade 1 logs declined 40 percent. Decreases ranged from 60 to more than 80 percent for such hardwoods as sugar maple, yellow birch, beech, and soft maple, which more than compensated for the increases in other species, notably basswood 6 percent, oak 25 percent, and aspen nearly 200 percent.

There is evidence from successive surveys that less desirable species are tending to displace preferred species in both the East and the West. Growth that is accumulating on inferior growing stock of both desirable and inferior species is of poor quality. Among the oaks, for example, which contribute three-eighths of eastern hardwood growth, it is estimated that 55 percent of the growth is attributable to the less desirable species.

Despite progress in technology to overcome poor quality, it still takes good wood, with relatively few exceptions, to make the kinds of wood and wood-fiber products needed in our expanding economy. Although the cut is mainly from the larger and better trees, successively smaller trees are being cut more and more, thus limiting future prospects for good-quality wood. Growth, on the other hand, is more uniformly distributed among trees of all sizes.

In summation, the quality of timber growth, like the quality of timber, is declining. The trend will need to be reversed if quality is not to become an increasing problem during the next several decades.

Annual Mortality

Because of losses from fire, insects, diseases, wind, and other causes, net annual growth as reported in the foregoing section is less than the amount of wood actually produced in the commercial forests. The amount, distribution, and rate of this annual mortality is the subject of this section.

The annual mortality for 1952 is estimated at 12.5 billion board-feet of sawtimber, or 3.5 billion cubic feet of growing stock (table 92). This estimate ascribes a loss to 1952 on the basis of current estimates tempered by known trends over a long period of years, exclusive of catastrophic losses. This concept is adopted to reduce the wide year-to-year impacts of severe fires or outbreaks of destructive insects and diseases.[32]

The annual mortality of softwood sawtimber is about four times that of hardwood sawtimber (table 92 and fig. 60). However, softwood growing-stock mortality is not quite twice as great as hardwood growing-stock mortality. These relations are approximately the same as for timber volume.

[32] These estimates differ slightly from estimates of actual mortality experienced in 1952 as reported in the section on Forest Protection, p. 185. The differences were entirely in the Northern Rocky Mountain Region, where insect losses in 1952 were greater than the trend level, and losses due to disease and weather and animals were slightly less. For more detail, see tables 17 and 64 to 68 of Basic Statistics in the appendix.

Table 92.—*Annual timber mortality in the United States and Coastal Alaska, by section and region, 1952* [1]

Section and region	Growing stock			Live sawtimber		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
North:						
New England	298	99	199	645	268	377
Middle Atlantic	233	64	169	354	115	239
Lake States	485	122	363	698	209	489
Central	102	4	98	312	13	299
Plains	28	2	26	70	5	65
Total	1, 146	291	855	2, 079	610	1, 469
South:						
South Atlantic	95	64	31	267	191	76
Southeast	314	149	165	841	455	386
West Gulf	220	85	135	660	326	334
Total	629	298	331	1, 768	972	796
West:						
Pacific Northwest:						
Douglas-fir subregion	551	537	14	3, 105	3, 056	49
Pine subregion	196	196	----------	932	932	----------
Total	747	733	14	4, 037	3, 988	49
California	359	336	23	1, 865	1, 811	54
Northern Rocky Mountain	308	306	2	1, 475	1, 472	3
Southern Rocky Mountain	200	179	21	906	849	57
Total	1, 614	1, 554	60	8, 283	8, 120	163
Total, United States	3, 389	2, 143	1, 246	12, 130	9, 702	2, 428
Coastal Alaska	100	100	(2)	392	392	(2)
United States and Coastal Alaska	3, 489	2, 243	1, 246	12, 522	10, 094	2, 428

[1] Estimates represent the current level of mortality indicated by trends over a long period of years as determined in 1952. For more detailed statistics see appendix tables 17 and 64. These estimates differ slightly from estimates of actual mortality experienced in 1952 as reported in the section on Forest Protection.

[2] Less than 0.5 million.

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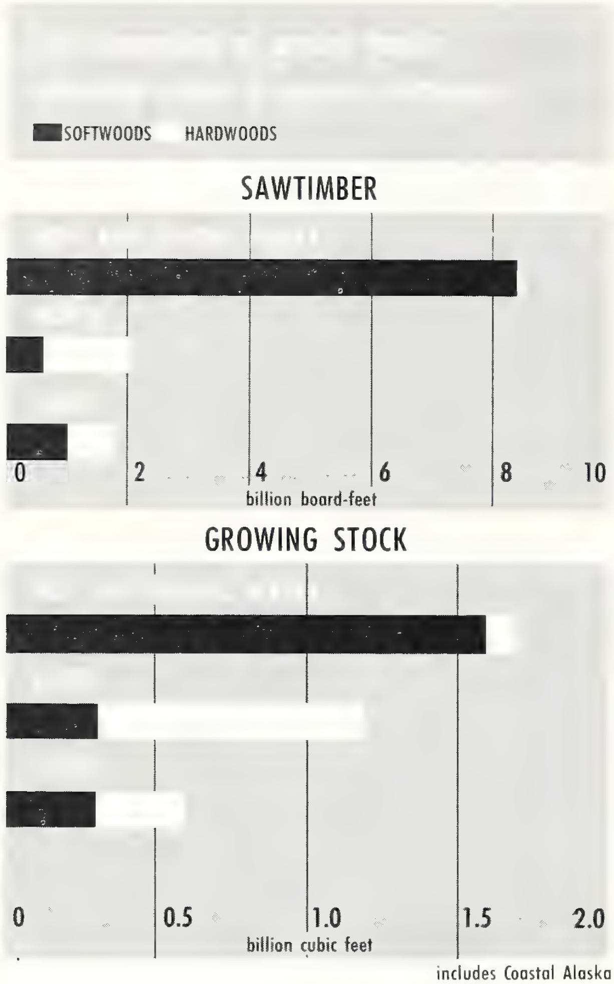


Figure 60.—Annual timber mortality, 1952.

Eighty percent of the softwood sawtimber mortality is in the West; 30 percent in the Douglas-fir subregion alone. This distribution of mortality is related to the concentration of softwood timber volume in the West, particularly in the Douglas-fir subregion, and to the high proportion of overmature timber in the West. Sixty percent of the hardwood sawtimber mortality is in the North. This is a greater proportion than for timber volume because the rates of 1952 mortality (mortality as a percentage of timber volume) are higher in the North than elsewhere:

	All species (percent)	Softwood (percent)	Hardwood (percent)
North	0.78	1.03	0.71
South	.50	.53	.46
West and Coastal Alaska	.61	.61	.58

The high rate of hardwood mortality in the North is believed to be related to widespread incidence of birch dieback and oak wilt and early susceptibility of aspen to stem canker. In softwood mortality rates, the difference between the North and the West and South is even more marked—presumably because of the greater susceptibility of northern species to windstorm and the early susceptibility of balsam fir to heart rot and white pine to blister rust.

Insects cause more mortality than either fire or disease in the South and West (table 93). In contrast to this, disease causes more mortality than either fire or insects in the North and in Coastal Alaska.

Table 93.—*Annual mortality of growing stock and live sawtimber, in the United States and Coastal Alaska, by cause and by section, 1952* [1]

GROWING STOCK

Cause	North	South	West	Coastal Alaska	Total, United States and Coastal Alaska
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Fire	36	126	73	1	236
Insects	65	112	766	27	970
Disease	461	73	190	49	773
Other [2]	584	318	585	23	1,510
Total	1,146	629	1,614	100	3,489

SAWTIMBER

Cause	North	South	West	Coastal Alaska	Total, United States and Coastal Alaska
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Fire	71	294	414	2	781
Insects	99	412	4,224	98	4,833
Disease	914	233	928	204	2,279
Other [2]	995	829	2,717	88	4,629
Total	2,079	1,768	8,283	392	12,522

[1] Estimates represent the current level of mortality indicated by trends over a long period of time as determined in 1952. These estimates differ slightly from estimates of actual mortality experienced in 1952 as reported in the section on Forest Protection. The differences were entirely in the Northern Rocky Mountain Region in the West, where insect losses in 1952 were greater than the trend level and losses due to disease and weather and animals were slightly less.

[2] Weather, animals, suppression, etc.

Causes other than fire, insects, and disease account for 37 percent of all sawtimber mortality and 43 percent of growing-stock mortality. The proportions are higher in the East than in the West. These losses include those from suppression and senility as well as those from windstorm, ice, animals, etc.[33]

Reduction of mortality from fire, insects, and disease is implicit in the more comprehensive and

[33] Causes of mortality and the full impact of these losses on growth are more fully discussed in the section on Forest Protection, p. 185.

more intensive protection that is being provided for our forest lands. Reduction of mortality—especially from insects that attack mature timber and from endemic diseases—is also implicit in the more intensive management which is being widely applied on public and industrial forest holdings in the present economic climate.

TIMBER PRODUCTS OUTPUT AND TIMBER CUT

It is encouraging to note that, for the country as a whole, there have been substantial gains in timber growth in recent years. Something of the adequacy of this growth can be learned from the quantity, kind, quality, and distribution of current timber cut.

The following analysis deals primarily with timber depletion due to cutting. Its purpose is to present statistics on output and source of timber products and analyze timber cut.

Timber Products Output

The American people utilize great quantities of lumber, pulpwood, and other timber products each year. Imports, though sizable in pulp and paper products, are not large in comparison with total needs. Most of the needs are supplied by our own forests. But not all the domestic output constitutes a drain on our commercial growing stock. Some of it is obtained from noncommercial forest land, some comes from salvage of dead and cull trees, some is taken from trees below the minimum sizes included in growing-stock inventory or from tops or limbs not included in the inventory. In addition to these roundwood sources, residues from the manufacture of certain products (such as lumber and veneer) are used as raw materials for other products (such as woodpulp) or as fuel. Thus, the term "timber products output" refers to the total output of timber products from all domestic raw-material sources.

More than 11 billion cubic feet of logs and bolts were harvested in 1952 (table 94). Of this amount, 9.4 billion cubic feet was from growing stock and 1.7 billion cubic feet, or 15 percent, came from cull and dead trees and other roundwood sources not included in growing stock. About half of the timber harvested for fuelwood, one-third of that for fence posts, and about one-tenth of the pulpwood and round mine timbers came from these supplementary sources, thus saving growing stock.

Plant residues also contributed significantly to total output. For every cord of fuelwood harvested as roundwood, the equivalent of more than one additional cord came from plant residues. Plant residues supplied the equivalent of 31.4 million cords of fuelwood. They also supplied the equivalent of 1.6 million cords of pulpwood, or 6 percent of the total output. Thirty million board-feet of lumber and 59 million cubic feet of

Table 94.—*Output and source of timber products in the United States and Coastal Alaska, by product, 1952*

Product	Domestic output [1]			Output from roundwood		
	Standard unit	Total	From plant residues	Total	Growing stock	Cull, dead trees, etc.[2]
		Million units	*Million units*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Saw logs (for lumber, timbers, sawn ties, etc.).	Board-foot lumber tally	39, 510	30. 2	6, 146	5, 801	345
Veneer logs and bolts	Board-foot log scale	2, 467		422	392	30
Cooperage logs and bolts	do	355		73	72	1
Pulpwood	Standard cords	25	1. 6	1, 823	1, 656	167
Fuelwood	do	59	31. 4	2, 008	966	1, 042
Piling	Linear feet	41		28	28	(3)
Poles	Pieces	6		88	88	(3)
Posts (round and split)	do	306	. 1	194	127	67
Hewn ties	do	10		67	66	1
Mine timbers (round)	Cubic feet	81	(4)	81	72	9
Other [5]	do	227	59. 0	168	125	43
Total				11, 098	9, 393	1, 705

[1] Estimates of domestic output include both roundwood and plant residues.

[2] In addition to cull and dead trees, includes trees of commercial species less than 5.0 inches in diameter and tops less than 4.0 inches in diameter, and trees from noncommercial forest land.

[3] Less than 0.5 million.

[4] Less than 0.05 million.

[5] Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and bolts for other miscellaneous products.

miscellaneous products were likewise obtained from plant residues.

More Timber Harvested for Saw Logs Than for All Other Products Combined

Saw logs for lumber, timbers, and sawn ties comprised 55 percent of all the roundwood utilized in 1952 (table 94). Fuelwood, pulpwood, and veneer logs and bolts came next in order, with 18, 16, and 4 percent, respectively. Together these 4 products accounted for almost 94 percent of the total. They also account for 94 percent of the output from growing stock, although here fuelwood drops to third place because much of it is obtained from dead or cull trees.

The 1952 saw-log output, representing 39.5 billion board-feet of lumber, was the greatest in 25 years (fig. 61). The 1952 pulpwood output of 25 million cords equaled the alltime record reached in 1951. Pulpwood output has been rising in all sections of the United States, but particularly in the South, where it is now about half as large as the saw-log output. The output of veneer logs and bolts was likewise at an alltime record. In contrast, the fuelwood trend is sharply downward.

Timber Cut

Timber products output serves as a measure of the importance of the forest products industries in national industrial activity. For appraising the long-range timber supply situation, however, we need to translate output statistics into terms of timber cut.

Timber cut as used here includes not only the roundwood volume of timber products cut from growing-stock inventory (table 94) but also the volume of growing stock cut, knocked down, or otherwise killed in logging and left unused in the woods (logging residues).[34]

[34] Timber cut is the equivalent of commodity drain in the 1945 Reappraisal.

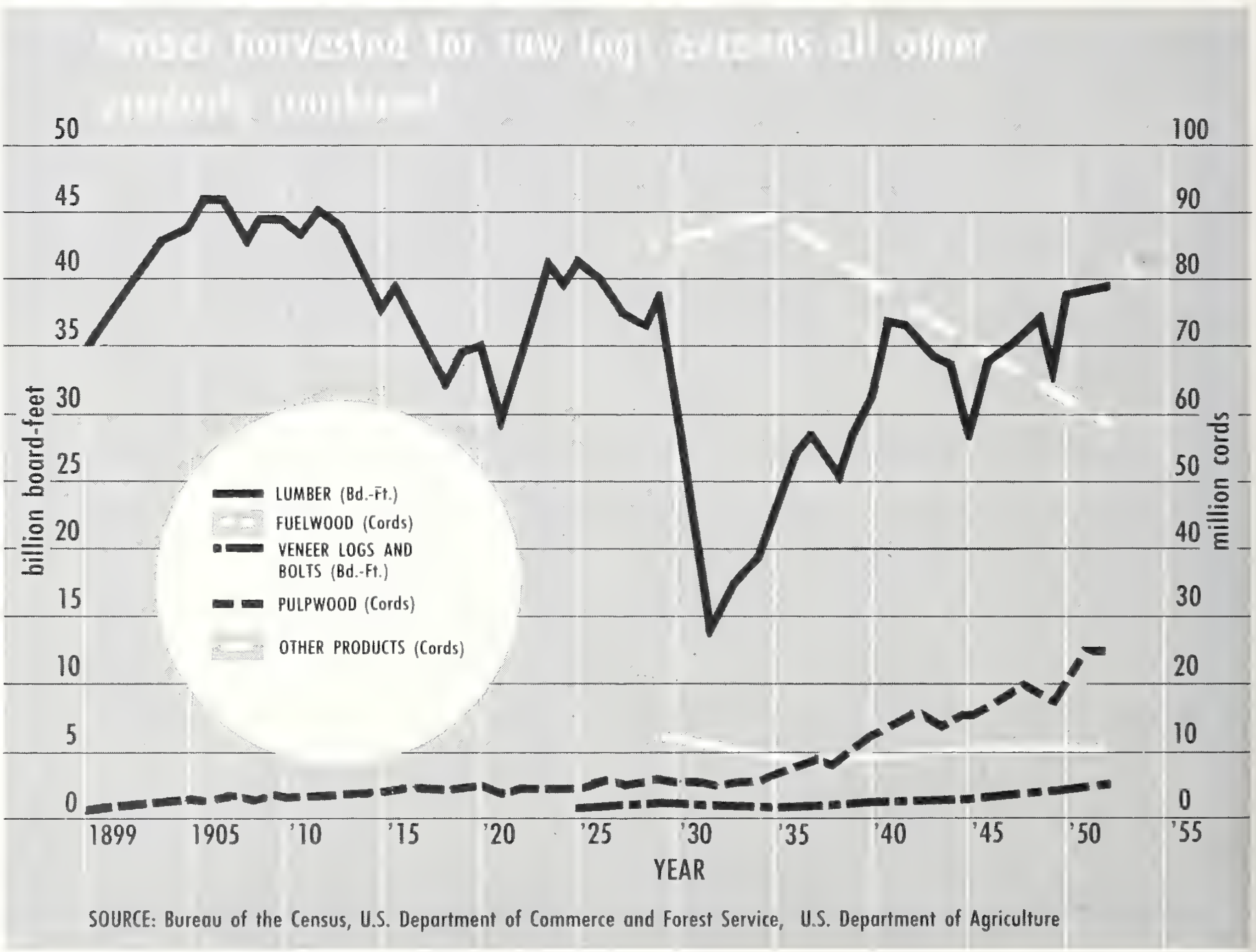
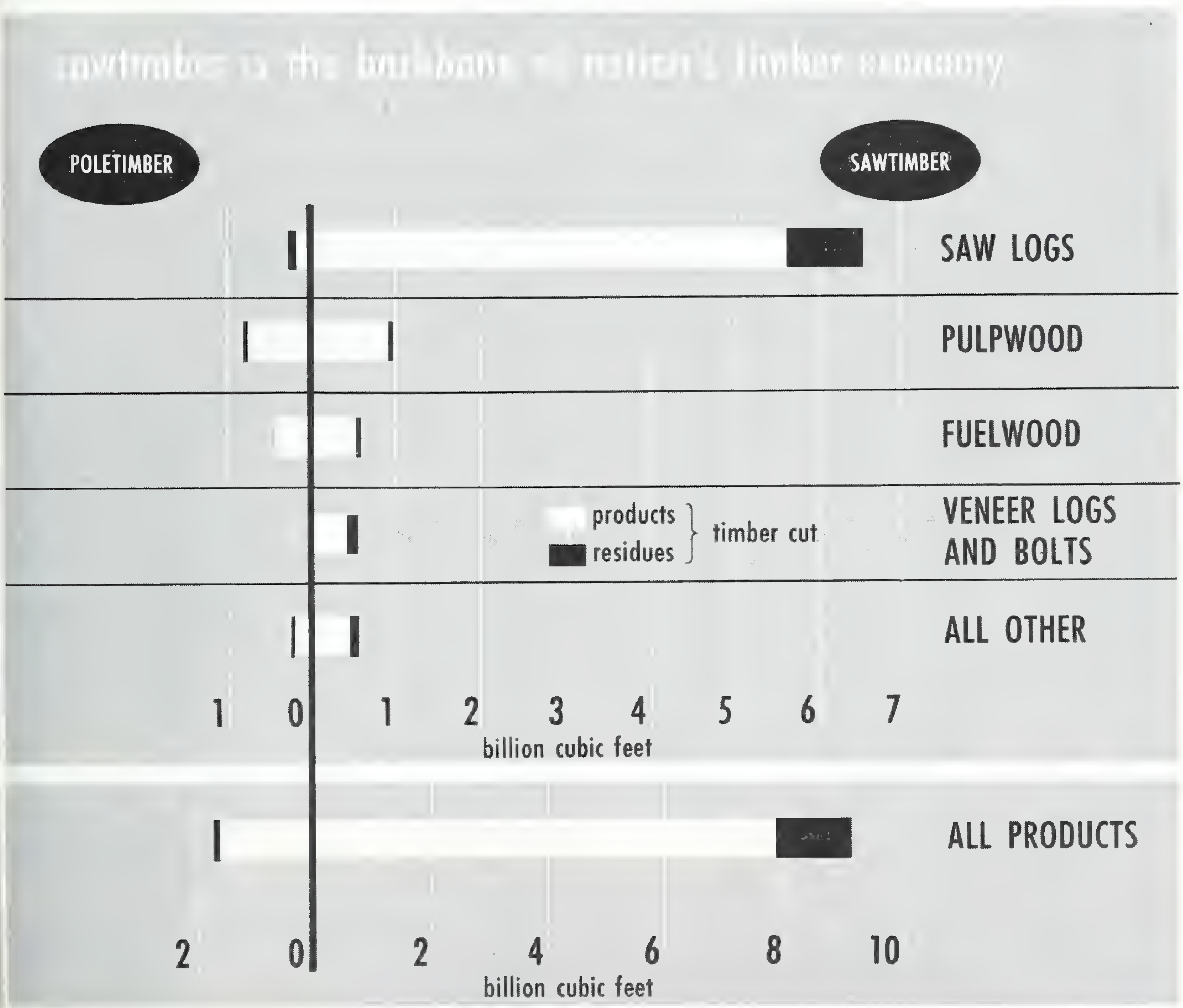


Figure 61

Anyone familiar with developments in timber harvesting will agree that improved practices and higher prices for timber products have made for closer utilization of the timber cut in recent years. Yet a substantial volume of the timber cut is never brought out of the woods. In 1952, logging residues were almost 1.4 billion cubic feet, or 13 percent of the total growing stock cut (table 95 and fig. 62). Logging residues are discussed more fully later in this section (p. 168).

Major Dependence Is on Sawtimber

Sawtimber has always been the backbone of the Nation's timber economy. In 1952, it comprised 84 percent of the 10.8 billion cubic feet of timber cut (table 95). Poletimber contributed only 16 percent. The preponderance of sawtimber in the total cut is, of course, understandable in the light of present low minimum sizes for sawtimber—9 inches for eastern softwoods and 11 inches for all other species. But it is worth emphasizing that even for products that do not require trees of sawtimber size, much of the cut is from sawtimber: Pulpwood, 56 percent; fuelwood, 53 percent; fence posts, 34 percent; and round mine timbers, 30 percent. The proportion of the cut of pulpwood coming from poletimber is undoubtedly rising as supplies of larger trees are less readily available to meet the increasing demand. Nevertheless, it generally costs less to cut pulpwood from trees over 9 inches in diameter in the East or 11 inches in the West than from trees below these sizes.



includes Coastal Alaska

Figure 62

TABLE 95.—*Timber cut in the United States and Coastal Alaska, by product and class of material, 1952*

Product	Growing stock			Sawtimber trees			Poletimber trees		
	Total cut	Timber products	Logging residues	Total cut	Timber products	Logging residues	Total cut	Timber products	Logging residues
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Saw logs (for lumber, timbers, sawn ties, etc.)	6, 821	5, 801	1, 020	6, 566	5, 624	942	255	177	78
Veneer logs and bolts	492	392	100	489	391	98	3	1	2
Cooperage logs and bolts	105	72	33	103	70	33	2	2	(1)
Pulpwood	1, 728	1, 656	72	975	922	53	753	734	19
Fuelwood	1, 004	965	39	537	500	37	467	465	2
Piling	32	28	4	31	27	4	1	1	(1)
Poles	102	88	14	92	79	13	10	9	1
Posts (round and split)	131	127	4	44	41	3	87	86	1
Hewn ties	108	67	41	106	66	40	2	1	1
Mine timbers (round)	77	72	5	23	21	2	54	51	3
Other [2]	157	125	32	103	76	27	54	49	5
Total	10, 757	9, 393	1, 364	9, 069	7, 817	1, 252	1, 688	1, 576	112

[1] Less than 0.5 million.
[2] Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and bolts for other such miscellaneous products.

Only a little poletimber appears in the cut of products normally requiring trees of sawtimber size. Much of this consists of trees knocked down, broken, or otherwise killed in the course of logging rather than trees actually cut for timber products. Nevertheless, 4 percent of the saw-log output comes from trees nominally below sawtimber size.

The West Leads in Timber Cut for Saw Logs and Veneer, the South for Pulpwood and Fuelwood

Because of the preponderance of large sawtimber, the West dominates the cut for saw logs and veneer logs and bolts. A little more than half the timber cut for these products, as well as 16 percent of the timber cut for pulpwood, originates here. The tabulation shows the major items of timber cut by the various sections in 1952:

	Saw logs (billion bd.-ft.)	Pulpwood (million cords)	Fuelwood (million cords)	Veneer logs and bolts (billion bd.-ft.)
North	4. 7	5. 7	3. 9	0. 3
South	13. 3	13. 2	9. 4	1. 0
West and Coastal Alaska	18. 6	3. 5	. 3	1. 5
Total	36. 6	22. 4	13. 6	2. 8

The South leads in pulpwood production because the development of the pulp and paper industry in this section is favored by good location with respect to the Nation's principal markets, available supplies of relatively cheap southern pine timber, reasonable security of future raw-material supplies (because of rapid tree growth), ample supplies of relatively cheap labor, water resources, chemicals and power, and excellent rail, water, and highway transportation. More timber is cut for fuelwood in the South chiefly because the rural people, by virtue of their generally low economic status, have sustained the use of wood fuel to a much greater extent than in other parts of the country.

The North accounts for 70 percent of the timber cut for round mine timbers—the only instance where the timber cut is greater in the North than in the South. However, saw logs for lumber represent the chief product here as elsewhere, and the North surpasses the West in timber cut for pulpwood and fuelwood, and for some minor items like cooperage, fence posts, and hewn ties.

When all products are combined, the South leads in both sawtimber and growing stock cut in cubic feet, whereas the West is foremost in sawtimber cut in board-feet (table 96).[35] About 22.5 billion board-feet, or 46 percent of the Nation's sawtimber cut in 1952, came from the West and Coastal Alaska. The South furnished 19.6 billion board-feet, or 40 percent. On the other hand, the *growing stock* cut in the South in 1952 was 5 billion cubic feet, or 47 percent of the Nation's total. In comparison, 35 percent of the growing stock cut was in the West and Coastal Alaska, and 18 percent in the North.

[35] The difference in the ranking in sawtimber cut in cubic feet and board-feet is due largely to the generally smaller timber cut in the South and correspondingly smaller board-foot content per cubic foot and to a lesser extent to the variation in minimum size for sawtimber (softwoods 9 inches and hardwoods 11 inches in the South and all species 11 inches in the West).

TABLE 96.—*Timber cut in the United States and Coastal Alaska, by section and region, and by class of material, 1952*

Section and region	Growing stock			Cut from pole-timber	Cut from sawtimber	
	Timber cut	Timber products	Logging residues			
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million bd.-ft.*
North:						
New England	500	455	45	114	386	1, 768
Middle Atlantic	470	412	58	107	363	1, 795
Lake States	537	474	63	271	266	1, 240
Central	405	362	43	112	293	1, 809
Plains	28	25	3	10	18	94
Total	1, 940	1, 728	212	614	1, 326	6, 706
South:						
South Atlantic	1, 455	1, 262	193	307	1, 148	5, 352
Southeast	2, 405	2, 077	328	476	1, 929	9, 411
West Gulf	1, 193	1, 008	185	230	963	4, 836
Total	5, 053	4, 347	706	1, 013	4, 040	19, 599
West:						
Pacific Northwest:						
Douglas-fir subregion	2, 031	1, 838	193	13	2, 018	12, 221
Pine subregion	359	321	38	3	356	2, 050
Total	2, 390	2, 159	231	16	2, 374	14, 271
California	932	765	167	8	924	5, 724
Northern Rocky Mountains	329	296	33	27	302	1, 899
Southern Rocky Mountains	100	87	13	10	90	555
Total	3, 751	3, 307	444	61	3, 690	22, 449
Total, United States	10, 744	9, 382	1, 362	1, 688	9, 056	48, 754
Coastal Alaska	13	11	2	(1)	13	86
United States and Coastal Alaska	10, 757	9, 393	1, 364	1, 688	9, 069	48, 840

1 Less than 0.5 million.

In the West, practically the entire cut is from sawtimber. In the South, 20 percent of the cut is from poletimber. In the North, as much as 32 percent of the cut is from poletimber and, in the Lake States Region where large timber is scarce, the cut of poletimber actually exceeds the cut of sawtimber.

Timber Cut Is Predominantly Softwoods

For the country as a whole, softwoods account for 70 percent of growing stock cut and 75 percent of the sawtimber cut (table 97 and fig. 63). The fact that the Nation's timber needs are pretty much geared to softwoods might logically be expected inasmuch as softwoods predominate in most sections of the country and are preferred for most products. In the West, of course, practically the entire supply consists of softwoods. In the South, about three-fifths of the cut is softwoods, whereas softwoods in the sawtimber inventory barely exceed hardwoods and are definitely in the minority in the growing-stock inventory. In the North, hardwoods are in greater abundance, a fact which is further reflected in timber cut. Nevertheless, softwoods in the North are likewise supplying a greater proportion of the cut in relation to inventory volume than hardwoods, thus reflecting a continued preference for softwoods here as elsewhere.

Of the timber cut for saw logs (6.8 billion cubic feet), about 77 percent was softwoods. Poles and piling were almost all softwood. Pulpwood, formerly almost entirely cut from softwood, is now 16 percent hardwood. Veneer logs and bolts are about half softwoods and half hardwoods.

Hardwoods were cut more exclusively for several products. For example, hardwoods accounted for 75 percent of timber cut for mine timbers, 72 percent for cooperage, and 70 percent for hewn ties.

Because of their abundance and utility, Douglas-fir and the southern yellow pines made up almost half of all the timber cut in 1952 (table 98 and

TABLE 97.—*Softwood and hardwood volumes cut in the United States and Coastal Alaska, by product, 1952*

Product	Growing stock			Live sawtimber		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Saw logs (for lumber, timbers, sawn ties, etc.)	6, 821	5, 214	1, 607	36, 636	28, 890	7, 746
Veneer logs and bolts	492	251	241	2, 803	1, 575	1, 228
Cooperage logs and bolts	105	29	76	516	143	373
Pulpwood	1, 728	1, 460	268	4, 693	4, 252	441
Fuelwood	1, 004	243	761	2, 246	595	1, 651
Piling	32	30	2	159	148	11
Poles	102	101	1	470	466	4
Posts (round and split)	131	49	82	218	69	149
Hewn ties	108	32	76	483	152	331
Mine timbers (round)	77	19	58	100	41	59
Other [1]	157	59	98	516	215	301
Total	10, 757	7, 487	3, 270	48, 840	36, 546	12, 294

[1] Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and bolts for other such miscellaneous products.

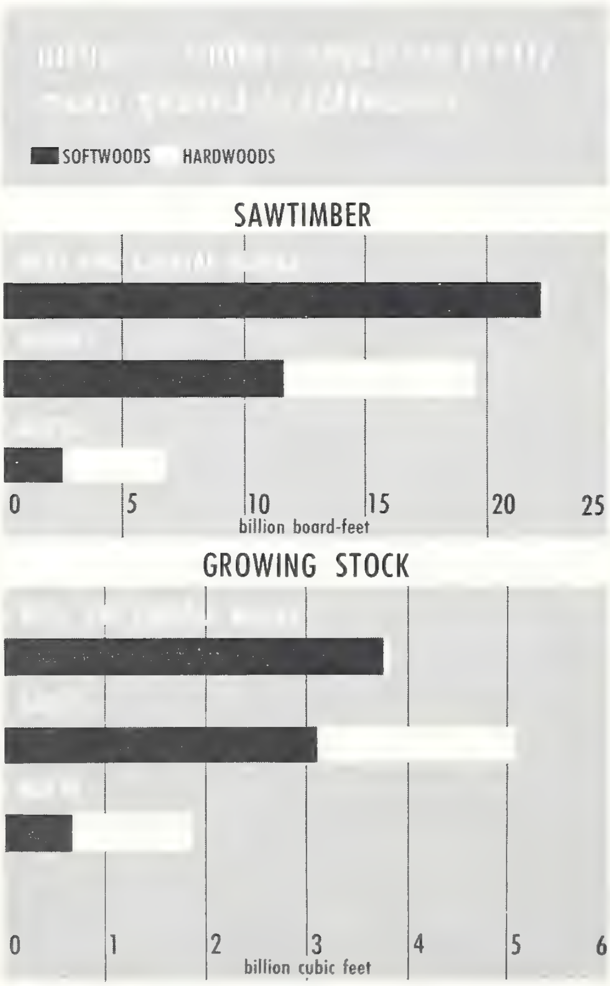


Figure 63

fig. 64). The oaks and the soft hardwoods (yellow-poplar, soft maple, sweetgum, tupelo and black-gum, cottonwood and aspen, and basswood) each constituted about 10 percent of the total cut and were next in order of importance.

In the North, hardwoods accounted for 4.3 billion board-feet or 65 percent of the total saw-timber cut (table 99). Of the hardwoods, the cut by species was oaks 37 percent; yellow birch, beech, and sugar maple 27 percent; yellow-poplar and other soft hardwoods 24 percent; and ash, hickory, walnut, and other hard hardwoods 12 percent (table 101, p. 165). White, red, and jack pine were the principal softwoods. This group made up 39 percent of the softwoods cut, spruce and fir 28 percent, the southern yellow pines 11 percent, and other softwoods including hemlock and larch 22 percent.

The cut of hardwoods was greatly in excess of softwoods in all northern regions except New England. The oaks were the principal hardwoods cut in the Middle Atlantic, Central, and Plains Regions. Yellow birch, beech, and sugar maple made up 39 percent of the hardwoods cut in the Lake States, and the soft hardwoods, chiefly aspen for pulp, 30 percent.

Softwoods cut in the Central and Plains Regions were chiefly the southern yellow pines. In the Lake States, about 42 percent of total softwoods was white, red, and jack pine; 46 percent other softwoods, mainly hemlock and larch; and 12 percent spruce and fir.

In contrast to other northern regions, nearly four-fifths of the cut in New England was softwoods. About one-half was white, red, and jack pine and one-half spruce and fir. The principal hardwoods were yellow birch, beech, and sugar maple.

TABLE 98.—*Timber cut in the United States and Coastal Alaska, by species group, 1952* [1]

Species group [2]	Growing stock	Live saw-timber
Eastern species:	*Million*	*Million*
Softwoods:	*cu. ft.*	*bd.-ft.*
White, red, and jack pine	257	972
Southern yellow pine	3, 029	11, 610
Spruce-fir	243	668
Other softwoods	217	841
Total, softwoods	3, 746	14, 091
Hardwoods:		
Yellow-poplar	217	988
Other soft hardwoods	1, 055	3, 892
Total	1, 272	4, 880
Oak	1, 292	4, 894
Beech-yellow birch-sugar maple	325	1, 290
Other hard hardwoods	358	1, 150
Total	1, 975	7, 334
Total hardwoods	3, 247	12, 214
Total, eastern species	6, 993	26, 305
Western species:		
Softwoods:		
Douglas-fir	1, 966	11, 962
Ponderosa and Jeffrey pine	605	3, 603
Western hemlock	377	2, 225
White and sugar pine	97	609
Redwood	163	987
Other softwoods	533	3, 069
Total, softwoods	3, 741	22, 455
Hardwoods	23	80
Total, western species	3, 764	22, 535
All softwoods	7, 487	36, 546
All hardwoods	3, 270	12, 294
All species	10, 757	48, 840

[1] Timber cut by species groups and regions is shown in tables 101, 102, and 103, of this section, and in the Basic Statistics, tables 47, 48, 51, and 52 of the appendix.

[2] Reference to the more important species in other softwoods, other soft hardwoods, and other hard hardwoods is found on page 158 of this report.

In the South, the southern yellow pines accounted for practically the entire cut of softwoods (table 102, p. 166). These species have for years been one of the country's mainstays for lumber and now assume this role also for pulp. In addition, they are in considerable demand for poles, piling, and container veneer, and supply the Nation's entire output of naval stores. The oaks contributed 42 percent of the hardwood cut, yellow-poplar 10 percent, other soft hardwoods 38 percent, and other hard hardwoods 10 percent.

The relationship of cut by species is about the same in each of the southern regions as in the

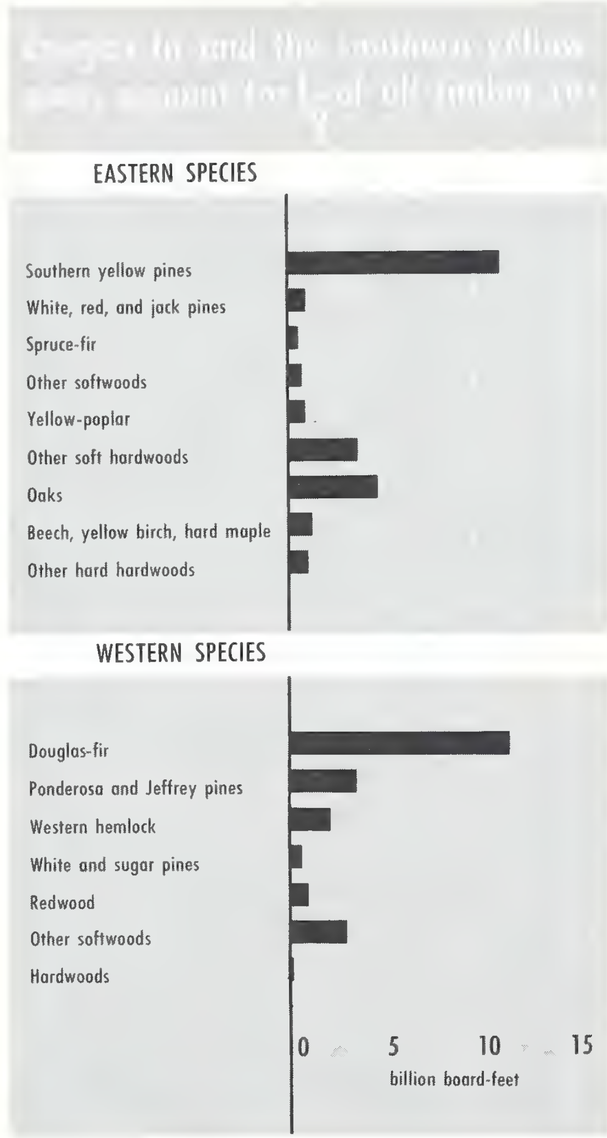


Figure 64

South as a whole. As would be indicated by its occurrence, the cut of yellow-poplar is confined chiefly to the South Atlantic and Southeastern Regions. The oaks supply one-half the total hardwood cut in the West Gulf as compared to two-fifths in the other two regions.

In the West, about 53 percent of the total cut was Douglas-fir (table 103, p. 167). Like the southern yellow pines, this species is used principally for lumber, but substantial quantities go into veneer, pulp, poles and piling, and a variety of other items. Because of its great utility and because most of it is old-growth quality timber, Douglas-fir is considered to be the most widely used commercial species in the world.

TABLE 99.—*Timber cut in the United States and Coastal Alaska, by softwoods and hardwoods, and by section and region, 1952*

Section and region	Growing stock			Live sawtimber		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
North:						
New England	500	361	139	1, 768	1, 381	387
Middle Atlantic	470	130	340	1, 795	508	1, 287
Lake States	537	188	349	1, 240	384	856
Central	405	17	388	1, 809	85	1, 724
Plains	28	4	24	94	12	82
Total	1, 940	700	1, 240	6, 706	2, 370	4, 336
South:						
South Atlantic	1, 455	916	539	5, 352	3, 360	1, 992
Southeast	2, 405	1, 479	926	9, 411	5, 724	3, 687
West Gulf	1, 193	651	542	4, 836	2, 637	2, 199
Total	5, 053	3, 046	2, 007	19, 599	11, 721	7, 878
West:						
Pacific Northwest:						
Douglas-fir subregion	2, 031	2, 022	9	12, 221	12, 169	52
Pine subregion	359	359	(1)	2, 050	2, 050	(1)
Total	2, 390	2, 381	9	14, 271	14, 219	52
California	932	921	11	5, 724	5, 704	20
Northern Rocky Mountain	329	328	1	1, 899	1, 897	2
Southern Rocky Mountain	100	98	2	555	549	6
Total	3, 751	3, 728	23	22, 449	22, 369	80
Total, United States	10, 744	7, 474	3, 270	48, 754	36, 460	12, 294
Coastal Alaska	13	13	----------	86	86	----------
United States and Coastal Alaska	10, 757	7, 487	3, 270	48, 840	36, 546	12, 294

[1] Less than 0.5 million.

Ponderosa and Jeffrey pine accounted for 16 percent of timber cut in the West. Containers, plywood, and millwork are important uses. Next in order were western hemlock, primarily for pulp (10 percent), redwood for lumber specialties (4 percent), and white and sugar pine (3 percent) also for specialty use such as mouldings and patterns, matches, and sash and door stock. "Other softwoods," including such species as the true firs for lumber, Sitka spruce for lumber and cooperage, western redcedar for shingles and poles, and lodgepole pine for mine timbers and poles, made up 14 percent of the cut.

The cut by species in various western regions occupies about the same order of dominance as does sawtimber volume. Thus Douglas-fir comprises 72 percent of the total cut in the Douglas-fir subregion—western hemlock 18 percent; ponderosa pine 66 percent in the pine subregion—Douglas-fir 18 percent. A similar relationship holds in the Northern and Southern Rocky Mountain Regions.

In Coastal Alaska, however, the cut has been heaviest in spruce, even though there is a greater volume in western hemlock. This is because lumber, the principal product so far, is cut mainly from spruce. Western hemlock is just now coming into prominence for pulp.

An Increasing Proportion of the Nation's Sawtimber Cut Has Come From the West

Various national studies dating from 1920 signify that the West has steadily assumed an increasing share of the sawtimber cut. In 1952, the West supplied about 20 percent more sawtimber than it did in 1944. A similar trend is apparent in growing stock cut, although the West's contribution averages about 11 percent

lower. The sawtimber cut in specified years, 1920–52, was as follows:

Date:[1]	Report:[2]	United States (billion bd.-ft.)	West Billion bd.-ft.	West Percent
1920	Capper Report	56.1	----	--
1930	Copeland Report	54.6	18.5	34
1938	Joint Congressional Committee	42.4	14.5	34
1944	Reappraisal	49.7	18.8	38
1952	Timber Resource Review	48.8	22.5	46

[1] Timber cut is not to be confused with timber drain as reported in the 1944 Reappraisal and previous national studies, because the drain estimates included not only the amount due to cutting for commodities but also losses from fire, epidemics of insects and disease, wind, ice, and other destructive agents. For purposes of comparability, only the volume removed by cutting in these various periods is listed here.

[2] For references, see section on Forest Land and Timber, p. 125.

Periodic estimates of timber cut are more nearly comparable than similar estimates of annual growth and even timber volume where changing standards, definitions, and concepts result in considerable differences from one period to another. Changing standards, such as size criteria for sawtimber, have not affected the estimates of timber cut appreciably. However, it was necessary to deduct the volume of hardwood limbs from the 1944 figures to make them comparable to the timber cut estimates for 1952.

Although output of major products has increased, the total 1952 sawtimber cut of 48.8 billion board-feet was not significantly different from the 1944 cut of 49.7 billion board-feet:

		Total (billion bd.-ft.)	Softwood (billion bd.-ft.)	Hardwood (billion bd.-ft.)
North	1944	8.3	2.8	5.5
	1952	6.7	2.4	4.3
South	1944	22.6	14.1	8.5
	1952	19.6	11.7	7.9
West	1944	18.8	18.7	.1
	1952	22.5	22.4	.1
United States	1944	49.7	35.6	14.1
	1952	48.8	36.5	12.3

The decrease in hardwoods cut between 1944 and 1952 was due largely to a declining use of fuelwood and to generally adverse conditions in hardwood lumber markets since World War II. The strong demand for lumber and pulp was responsible for the increased cut of softwoods. Not reflected in the figure for softwoods is the considerable cut of dead and cull trees and plant residues used for fuel and pulp, which tended to hold the cut of live sawtimber lower than it might otherwise have been.

The cut of softwood sawtimber increased only in the West. The 20-percent rise reflected mainly an increase in California, where the cut more than doubled between 1944 and 1952. In addition, substantial percentage increases took place in the two Rocky Mountain Regions in response to the strong demand for softwood lumber. The rising trend in the West will ultimately be reversed as the old growth is cut over and as cut is more nearly related to forest area and growth capacities of the land. The South will hold important advantages when the forest economy in the West, as in other sections, is based primarily on second-growth timber.

In contrast to the West, the cut of softwood sawtimber dropped about 16 percent in both the South and North. Of the three southern regions, the West Gulf suffered the largest decrease. The decline in the South, as a whole, is particularly significant in view of the greatly increased pulp-mill capacity brought into operation during the period. The resulting increase in softwood cut for pulp, from 7.2 to 11.8 million cords between 1944 and 1952, is therefore indicated as being almost entirely from poletimber.

The decrease in the cut of softwood sawtimber in the North was more pronounced in the Lake States than elsewhere, reflecting the general scarcity of the larger timber in this region.

COMPARISON OF GROWTH AND CUT

For the country as a whole, it appears that sawtimber growth is not quite equal to cut but that growth of growing stock is 32 percent in excess of growing stock cut (table 100 and fig. 65).

In the near-balance for sawtimber, a growth deficiency of 8½ billion board-feet of softwoods is largely hidden by a surplus of over 7 billion board-feet of hardwood growth, mostly in the North. Similarly, in the near-balance for sawtimber, a 10 billion board-foot excess of growth over cut in the East is offset by an 11 billion board-foot deficit in the West.

These figures indicate how misleading an overall comparison of growth and cut may be. For one thing, the significance of the comparison is quite different in the West, where there is still a large volume of old-growth timber, from what it is in the East, where a balance of growth and cut is of much more significance.

Even where applied to specific local or regional situations, comparisons of growth and cut must be interpreted with caution. The level at which comparisons are made are extremely important. For example, situations where cutting has declined because of limited merchantable timber or other reasons are more likely to show favorable relations between growth and cut. On the other hand, situations where cutting is at a high level because of active and diversified demand or remaining old growth are more likely to show unfavorable relations.

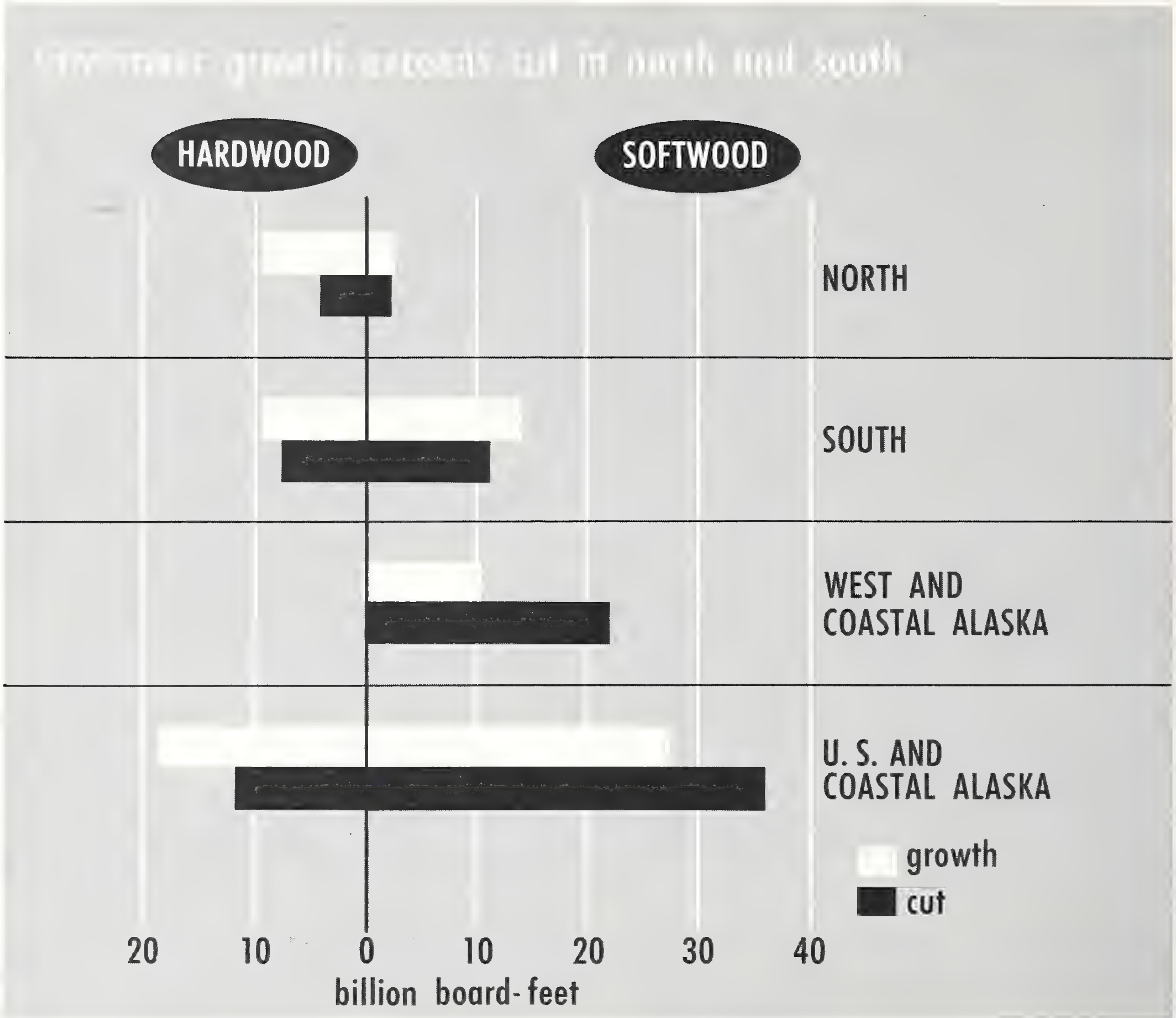


Figure 65

The final criterion is a balancing of annual timber growth of appropriate species and tree size with timber cut needed to meet future demands. Nevertheless, analysis of current growth-cut relations is of value since it contributes to an appraisal of whether future growth and needs will balance.

Softwood Growth Exceeds Timber Cut in the East

In the East, annual growth of softwoods, as well as that of hardwoods, exceeds the corresponding timber cut for both growing stock and sawtimber. In the North, the margin for softwood sawtimber is 4 percent, in the South 24 percent. This favorable balance for softwood sawtimber in the South is one of the most significant findings of this report. It augurs well for the future. Nevertheless, this favorable growth situation is somewhat impaired by the fact that it has been achieved as much by reducing cut as by increasing annual growth. Both growth and cut are far below the productive capacity of the land.

In contrast, growth in the West, almost entirely softwood, is only 50 percent of cut. However, in the present transition from virgin to young timber, annual growth should not be expected to equal cut. Comparison of growth and cut does not provide a helpful criterion of the situation in the West.

TABLE 100.—*Comparison of net annual timber growth and timber cut in the United States and Coastal Alaska, 1952* [1]

Species group and section	Growing stock			Live sawtimber		
	Growth	Cut	Ratio of growth to cut [2]	Growth	Cut	Ratio of growth to cut [2]
	Billion cu. ft.	*Billion cu. ft.*		*Billion bd.-ft.*	*Billion bd.-ft.*	
All species:						
North	4. 66	1. 94	2. 40	12. 07	6. 70	1. 80
South	6. 80	5. 06	1. 35	24. 02	19. 60	1. 22
West and Coastal Alaska	2. 78	3. 76	. 74	11. 31	22. 54	. 50
Total	14. 24	10. 76	1. 32	47. 40	48. 84	. 97
Softwood:						
North	. 82	. 70	1. 17	2. 47	2. 37	1. 04
South	3. 56	3. 05	1. 17	14. 50	11. 72	1. 24
West and Coastal Alaska	2. 63	3. 74	. 70	11. 04	22. 46	. 49
Total	7. 01	7. 49	. 93	28. 01	36. 55	. 77
Hardwood:						
North	3. 84	1. 24	3. 10	9. 60	4. 33	2. 21
South	3. 24	2. 01	1. 62	9. 52	7. 88	1. 21
West and Coastal Alaska	. 15	. 02	6. 48	. 27	. 08	3. 31
Total	7. 23	3. 27	2. 21	19. 39	12. 29	1. 58

[1] For comparisons by regions, see appendix tables 57 through 62.
[2] Ratios computed before rounding.

THE MORE DESIRABLE SPECIES GENERALLY HAVE THE LESS FAVORABLE GROWTH-CUT RELATIONS

Heavy cutting of the more desirable species and limited markets for the less desirable tend to make the growth-cut relations for the former less favorable than for the latter (figs. 66 and 67).

Among eastern softwoods, for example, sawtimber growth of white, red, and jack pine remains less than cut; spruce and fir come next in order with growth not greatly in excess of cut. For the southern yellow pines, the ratio of growth to cut is 1.22. "Other softwoods," including the less valuable hemlock, have the highest ratio of growth to cut.

Among the eastern hardwoods, yellow-poplar, a species of specialized value, is being cut somewhat faster than it is growing. For other soft hardwoods—those which have access to pulpwood markets but are not generally otherwise under pressure—growth is about 1½ times cut. Similar ratios appear for the oaks and beech, yellow birch and sugar maple—groups which include species of mixed value. For other hard hardwoods—a group which includes many relatively less desirable species—sawtimber growth is 2½ times the cut. Such relations point clearly to an increase in the proportion of the less desirable species in our future timber supply.

	Ratio of growth to cut	
	Sawtimber	*Growing stock*
Eastern species:		
Spruce and fir	1. 11	1. 20
White, red, and jack pines	. 93	1. 05
Southern yellow pines	1. 22	1. 15
Other eastern softwoods	1. 39	1. 57
Yellow-poplar	. 96	1. 33
Other soft hardwoods	1. 55	2. 17
Oaks	1. 49	1. 92
Beech, yellow birch, and sugar maple	1. 46	2. 21
Other hard hardwoods	2. 56	3. 65
Western species:		
Douglas-fir	. 37	. 46
Ponderosa and Jeffrey pines	. 51	. 79
Western hemlock	. 47	. 63
White and sugar pines	. 88	1. 03
Redwood	. 40	. 47
Other western softwoods	. 91	1. 56
Western hardwoods	3. 31	6. 48

In the West—where cutting is largely in virgin timber with little or no net growth—the smallest ratio of sawtimber growth to cut, 37 percent, is that for Douglas-fir, the most heavily used species. The ratios for redwood, western hemlock, and ponderosa and Jeffrey pines are somewhat higher. But for "other softwoods," the group that includes such less desirable species as white and red fir and lodgepole pine, annual growth is 91 percent of cut. Western white and sugar pines appear as an exception to the progression. For these highly prized species, the ratio is almost as high as for "other softwoods."

An Excess of Growing-Stock Growth Over Cut Is Important for Continued Sawtimber Balance

In table 100 and the preceding text tabulation, it will be seen that the ratios of growth to cut for growing stock are generally higher than corresponding ratios for sawtimber. This simply means that growth-cut balances are better when we consider merchantable trees of all sizes than when we consider only the larger and generally higher quality trees.

Growth is distributed more uniformly than cut among trees of all size classes. So long as most of the commercial timber is cut from the large trees, therefore, a balance of cubic-foot growth and cut of total growing stock will not give a balance of sawtimber growth and cut. Conversely, with anything like the present pattern of size classes in timber cut, a balance of sawtimber growth and cut will generally be accompanied by a surplus of growth over cut of total growing stock.

For this reason, growth-cut ratios for sawtimber are more significant than those for growing stock. If sawtimber ratios are favorable, growing-stock ratios are likely to be even more so; but a favorable growing-stock ratio may be misleading if the sawtimber relations are not also considered.

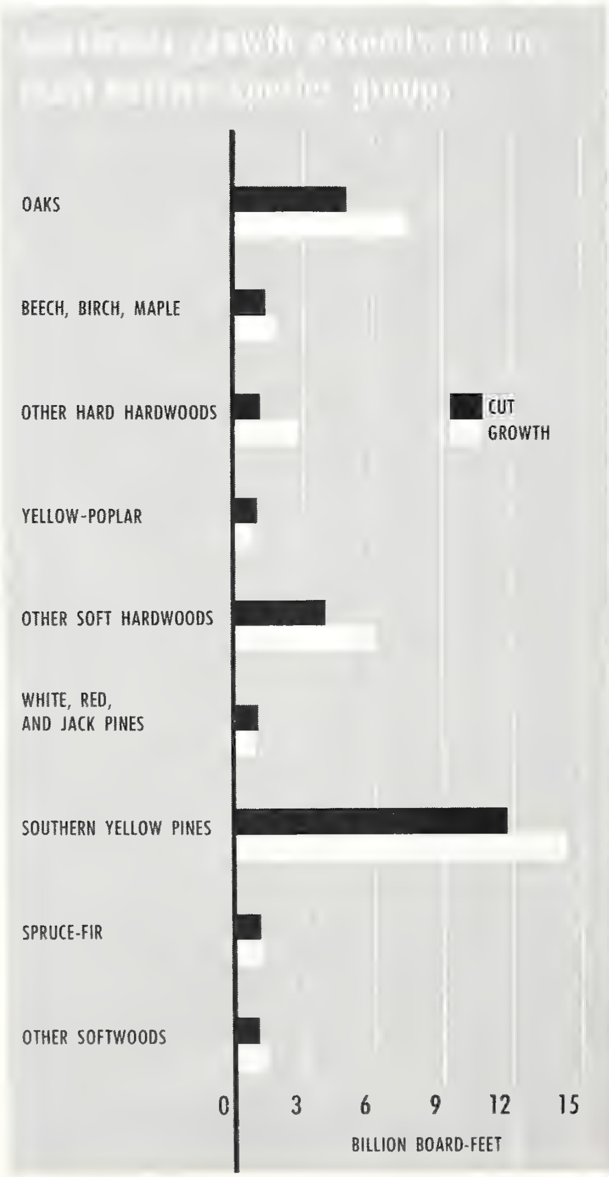
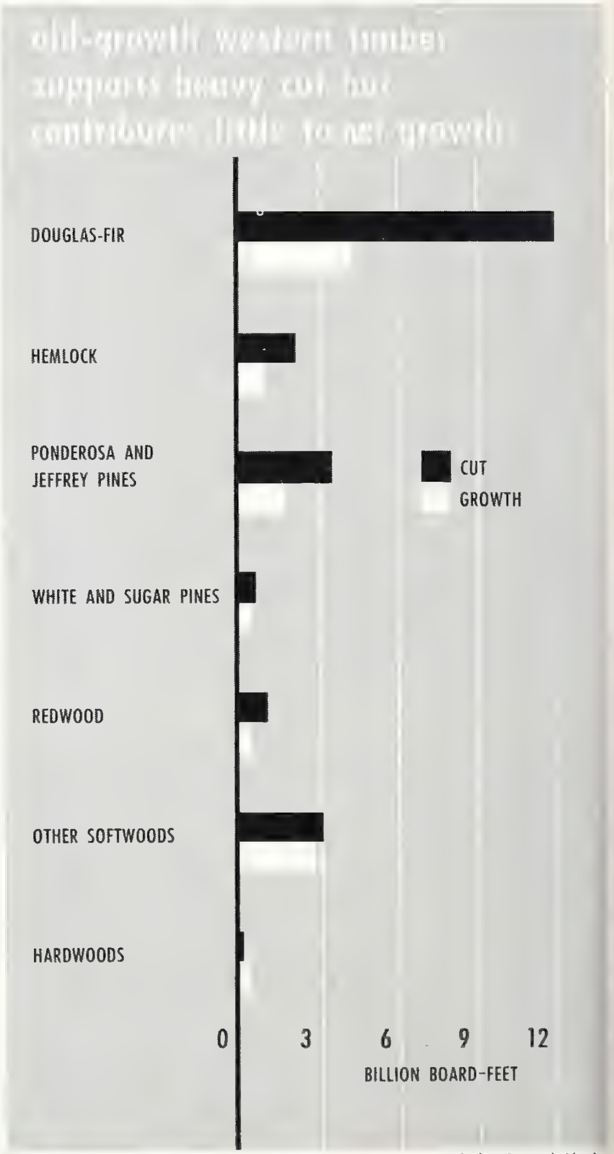


Figure 66



includes Coastal Alaska

Figure 67

Other Significant Aspects Revealed in Sawtimber Analysis by Regions

New England.—In contrast to the overall situation in the East, softwoods are being overcut in New England; sawtimber growth is only about two-thirds of sawtimber cut (table 101). The overcut is most pronounced in white pine, less so for spruce and fir. "Other softwoods," chiefly hemlock, show the most favorable growth-cut ratio, 96 percent.

Hardwood growth is 2.4 times the sawtimber cut, but soft hardwoods other than yellow-poplar are an exception. Much of the hardwood growth is in timber of small size and poor quality.

Middle Atlantic.—In this region also, softwood sawtimber growth falls below the cut (table 101). The overcut, however, is confined to white pine and southern yellow pine. For softwoods other than the pines, growth exceeds cut by a substantial margin. The heaviest overcut is in the southern pine stands of New Jersey. Hardwood growth, much of it inferior, is 2.1 times the sawtimber cut.

In both the Middle Atlantic and New England Regions, development of markets for the accum-

TABLE 101.—*Timber cut and net annual growth of live sawtimber in the North, by species group and region, 1952*

Species group and item	Total, North	New England	Middle Atlantic	Lake States	Central	Plains
Softwoods:	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
White, red, and jack pine:						
Cut	929	618	149	162	(1)	----------
Growth	845	298	124	417	6	----------
Southern yellow pine: [2]						
Cut	257	8	178	----------	61	10
Growth	317	2	107	----------	184	24
Spruce and fir:						
Cut	668	560	64	44	----------	----------
Growth	741	426	67	248	----------	----------
Other softwoods:						
Cut	516	195	117	178	24	2
Growth	572	188	172	137	59	[3] 16
Total, softwoods:						
Cut	2, 370	1, 381	508	384	85	12
Growth	2, 475	914	470	802	249	40
Hardwoods:						
Yellow-poplar:						
Cut	174	1	76	----------	97	----------
Growth	323	5	155	----------	163	----------
Other soft hardwoods:						
Cut	876	86	217	260	283	30
Growth	2, 678	70	391	1, 239	742	236
Total, soft hardwoods:						
Cut	1, 050	87	293	260	380	30
Growth	3, 001	75	546	1, 239	905	236
Oaks:						
Cut	1, 614	41	486	157	899	31
Growth	3, 486	125	983	440	1, 872	66
Beech, yellow birch, sugar maple:						
Cut	1, 178	245	409	333	191	(1)
Growth	1, 722	534	733	158	297	----------
Other hard hardwoods:						
Cut	494	14	99	107	254	20
Growth	1, 390	209	428	54	640	59
Total, hard hardwoods:						
Cut	3, 286	300	994	597	1, 344	51
Growth	6, 598	868	2, 144	652	2, 809	125
Total, hardwoods:						
Cut	4, 336	387	1, 287	857	1, 724	81
Growth	9, 599	943	2, 690	1, 891	3, 714	361
Total, all species:						
Cut	6, 706	1, 768	1, 795	1, 241	1, 809	93
Growth	12, 074	1, 857	3, 160	2, 693	3, 963	401

[1] Less than 0.5 million board-feet.

[2] The species for which the group is named are generally most abundant, but they may be scarce or absent in some areas. In New England, pitch pine is the chief representative of the southern yellow pine group.

[3] Net growth of ponderosa pine. The total net growth of ponderosa and Jeffrey pipe in the United States is 1,857 million board-feet, including 16 million board-feet in the Plains Region.

ulating hardwood growth presents a major challenge.

Lake States.—In the Lake States the softwood situation differs from that in New England. Growth of white, red, and jack pines and of spruce and fir is greatly in excess of sawtimber cut: 2½ times for pine and 5½ times for spruce and fir (table 101). The demand for jack pine—now the principal pine marketed in the Lake States—does not appear to be keeping pace with the current wave of young timber reaching sawtimber size.

In contrast to the generally favorable hardwood situation is the unfavorable relation between sawtimber growth and cut of beech, yellow birch, and sugar maple in the Lake States Region. The cut of these species is more than double the annual growth. This means rapid depletion of the remaining old-growth hardwood timber. The Lake States Region also differs from most other eastern regions in an overcut of "other softwoods," chiefly hemlock, a species commonly associated with beech, yellow birch, and sugar maple.

Growth of oaks in the Lake States is about three times the sawtimber cut. As in the Northeast, however, much of the oak is of poor quality. Growth of soft hardwoods, chiefly aspen, is almost five times the cut. Markets for aspen still fall far short of the available supply.

Central and Plains Regions.—In the Central and Plains Regions, growth, predominantly hardwood, is more than twice the sawtimber cut (table 101). A substantial excess of growth is shown for every species group.

South Atlantic.—In the South Atlantic Region, sawtimber growth exceeds cut for all species groups except yellow-poplar, which is being overcut about 4 percent (table 102). There is not much excess growth for southern yellow pines (8 percent). The most favorable relation (growth 4.2 times cut) appears in "other hard hardwoods," the group which includes some of the least desirable species.

Southeast.—In the Southeast, not only yellow-poplar but also other soft hardwoods and the oaks run counter to the generally favorable growth-cut situation for the South (table 102). Yellow-poplar is being heavily overcut, the other two groups less so. As in the South Atlantic Region, the less desirable hard hardwoods have the most favorable ratio.

The excess of sawtimber growth over cut of southern yellow pine is 15 percent—somewhat greater than in the South Atlantic Region.

West Gulf.—The West Gulf Region shows a greater surplus of southern yellow pine growth (54 percent) than any other region (table 102). There is a general surplus of hardwood growth, with the hard hardwoods again showing the highest ratio.

Pacific Northwest.—In the Pacific Northwest, the growth of all softwoods has reached about 40 percent of sawtimber cut (table 103). Growth of Douglas-fir and ponderosa pine is only about one-third of the cut of these species, but growth of "other softwoods" does not fall far below cut. In this and other western regions, growth-cut ratios mean little because the large volume of old-growth timber supports a large cut but contributes little to annual growth.

California.—In California, the relations are similar to those in the Pacific Northwest, except that for "other softwoods" (white and red fir,

TABLE 102.—*Timber cut and net annual growth of live sawtimber in the South, by species group and region, 1952*

Species group and item	Total, South	South Atlantic	Southeast	West Gulf
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Softwoods:				
White, red, and jack pine:				
Cut	43	30	13	
Growth	61	41	20	
Southern yellow pine:				
Cut	11, 353	3, 228	5, 546	2, 579
Growth	13, 838	3, 493	6, 378	3, 967
Spruce and fir:				
Cut	(1)	(1)		
Growth	1	1		
Other softwoods:				
Cut	325	102	165	58
Growth	595	135	281	179
Total, softwoods:				
Cut	11, 721	3, 360	5, 724	2, 637
Growth	14, 495	3, 670	6, 679	4, 146
Hardwoods:				
Yellow-poplar:				
Cut	813	400	409	4
Growth	625	383	239	3
Other soft hardwoods:				
Cut	3, 017	662	1, 504	851
Growth	3, 363	1, 018	1, 254	1, 091
Total, soft hardwoods:				
Cut	3, 830	1, 062	1, 913	855
Growth	3, 988	1, 401	1, 493	1, 094
Oaks:				
Cut	3, 280	804	1, 405	1, 071
Growth	3, 830	1, 334	1, 257	1, 239
Beech, yellow birch, and sugar maple:				
Cut	112	23	71	18
Growth	155	38	73	44
Other hard hardwoods:				
Cut	656	103	298	255
Growth	1, 549	437	533	579
Total, hard hardwoods:				
Cut	4, 048	930	1, 774	1, 344
Growth	5, 534	1, 809	1, 863	1, 862
Total, hardwoods:				
Cut	7, 878	1, 992	3, 687	2, 199
Growth	9, 522	3, 210	3, 356	2, 956
Total, all species:				
Cut	19, 599	5, 352	9, 411	4, 836
Growth	24, 017	6, 880	10, 035	7, 102

[1] Less than 0.5 million board-feet.

TABLE 103.—*Timber cut and net annual growth of live sawtimber in the West and Coastal Alaska, by species group and region, 1952* [1]

Species group and item	Total, West and Coastal Alaska	Pacific Northwest			California	Northern Rocky Mountain	Southern Rocky Mountain	Coastal Alaska
		Total	Douglas-fir subregion	Pine subregion				
Softwoods:	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Douglas-fir:								
Cut	11, 962	9, 193	8, 827	366	2, 333	393	43	-----
Growth	4, 431	3, 193	3, 022	171	787	388	63	-----
Ponderosa and Jeffrey pine:								
Cut	3, 603	1, 497	149	1, 348	1, 274	475	357	-----
Growth	[2] 1, 841	496	57	439	553	368	424	-----
Western hemlock:								
Cut	2, 225	2, 193	2, 172	21	2	9	-----	21
Growth	1, 038	931	911	20	9	27	-----	71
White and sugar pine:								
Cut	609	63	23	40	324	222	-----	-----
Growth	535	119	98	21	207	209	-----	-----
Redwood:								
Cut	987	-----	-----	-----	987	-----	-----	-----
Growth	396	-----	-----	-----	396	-----	-----	-----
Other softwoods:								
Cut	3, 069	1, 273	998	275	784	798	149	65
Growth	2, 800	1, 095	922	173	943	516	190	56
Total, softwoods:								
Cut	22, 455	14, 219	12, 169	2, 050	5, 704	1, 897	549	86
Growth	11, 041	5, 834	5, 010	824	2, 895	1, 508	677	127
Hardwoods:								
Cut	80	52	52	([3])	20	2	6	-----
Growth	265	143	139	4	44	26	51	1
Total, all species:								
Cut	22, 535	14, 271	12, 221	2, 050	5, 724	1, 899	555	86
Growth	11, 306	5, 977	5, 149	828	2, 939	1, 534	728	128

[1] Growth-cut relations for western species mean little because of the old-growth timber, which provides a large base but contributes little to net growth.
[2] Excludes 16 million board-feet of net growth of ponderosa pine in the Plains Region. The total net growth of ponderosa and Jeffrey pine in the United States is 1,857 million board-feet.
[3] Less than 0.5 million board-feet.

incense-cedar, lodgepole pine, etc.) sawtimber growth exceeds cut by 20 percent (table 103). This group includes the less desirable species.

Northern Rocky Mountain.—Softwood growth in the Northern Rocky Mountain Region is 80 percent of the sawtimber cut (table 103). In contrast to the usual situation, the relationship is more favorable for Douglas-fir, white pine, and ponderosa pine than for "other softwoods."

Southern Rocky Mountain.—In contrast to other western regions, sawtimber growth in the Southern Rocky Mountain Region exceeds cut in all species groups (table 103). This is a reflection of age-class distribution and stocking conditions and limited industrial development of the region.

Coastal Alaska.—Growth in Coastal Alaska, although confined largely to the limited areas of second-growth timber, is somewhat greater than the cut in 1952. This situation will doubtless be reversed now that the pulp industry has become established in Alaska, and will continue until sufficient cutover area has restocked and reached sawtimber size to balance the cut of mature old growth. Coastal forests are just entering a period of conversion from virgin to managed stands.

The Relation Between Growth and Cut Is Generally Improved Over 1944

Because of factors previously cited (p. 149), direct comparisons of net growth-cut relations in 1952 with the gross growth-drain relations of 1944 are decidedly misleading. Adjustment of 1944 data to 1952 standards corrects for this lack of comparability and makes a comparison of 1944 and 1952 relations possible.

One of the most favorable features of growth-cut comparisons with respect to future outlook is the apparent improvement in both eastern softwoods and eastern hardwoods since 1944 (table 104). Whereas the growth of eastern softwood sawtimber was indicated to be about 10 percent less than cut in 1944, it was estimated to be 21 percent greater than cut in 1952. For hardwoods, sawtimber growth exceeded cut in both periods—

TABLE 104.—*Sawtimber and growing-stock growth and cut in continental United States, by species groups, 1944 and 1952*

Species	Sawtimber				Growing stock			
	1944 [1]		1952		1944 [1]		1952	
	Volume	Ratio of growth to cut	Volume	Ratio of growth to cut	Volume	Ratio of growth to cut	Volume	Ratio of growth to cut
	Billion bd. ft.		*Billion bd. ft.*		*Billion cu. ft.*		*Billion cu. ft.*	
All species:								
Net annual growth	43. 4	0. 88	47. 3	0. 97	12. 5	1. 09	14. 2	1. 31
Timber cut	49. 7		48. 8		11. 5		10. 8	
Eastern softwoods:								
Net annual growth	15. 2	. 90	17. 0	1. 21	3. 8	. 93	4. 4	1. 16
Timber cut	16. 9		14. 1		4. 1		3. 8	
Eastern hardwoods:								
Net annual growth	16. 6	1. 19	19. 1	1. 57	6. 0	1. 43	7. 0	2. 19
Timber cut	14. 0		12. 2		4. 2		3. 2	
Western softwoods:								
Net annual growth	11. 3	. 60	10. 9	. 49	2. 7	. 82	2. 6	. 70
Timber cut	18. 7		22. 4		3. 2		3. 7	

[1] Adjusted as noted on p. 149 to make 1944 Reappraisal figures comparable to those of 1952.

by 19 percent in 1944 and 57 percent in 1952. The improvement for both softwoods and hardwoods resulted from the combined effects of increased growth and reduced cut.

Exceptions to this general rule are noted for New England softwoods and South Atlantic hardwoods (table 105). New England sawtimber softwoods had an even less favorable ratio in 1952 than in 1944; continued depletion of sawtimber growing stock has caused annual growth to decline while cut remained almost unchanged. Likewise, the ratio for South Atlantic hardwood sawtimber was less favorable in 1952 than in 1944 because an exceptional increase in cut outweighed the substantial increase in growth.

Also in contrast to the generally favorable trend in the East, an opposite trend is noted in western softwoods. Whereas sawtimber growth remained essentially unchanged between 1944 and 1952, cut rose from 18.7 to 22.4 billion board-feet, or nearly 20 percent. Growth was estimated to be 60 percent of cut in 1944 and only 49 percent of cut in 1952. The greatest drop was experienced in California, where the cut increased greatly while growth remained without material change. Western softwood growth was apparently held down in 1952 because of accelerated cutting in second-growth stands and abnormally heavy losses from the bark-beetle outbreak in the Northern Rocky Mountain Region.

Trends in growth-cut relationships for growing stock (eastern softwoods, eastern hardwoods, and western softwoods) are similar to those for saw timber and are generally more favorable.

These comparisons emphasize three points that have previously been brought out: (1) Overall improvement is due almost entirely to hardwoods; (2) the West is under increasing pressure to supply the country's need; and (3) the favorable trend in growth-cut ratios for softwoods in the East, while encouraging for the future, must be tempered by realization that the improvement reflects a decline in timber cut as much as it does an increase in annual growth.

LOGGING AND PLANT RESIDUES

Finding use for the wood residues which are inevitable in logging and manufacture is one of the most formidable problems in the utilization field. Good progress has been made over the years in reducing the amount of residues left in the woods and in using residues developed at sawmills, veneer and plywood plants, pulp mills, and other primary forest products establishments. Yet there is still a great quantity of unused residue, and much that is now burned for fuel might be put to a better purpose.

Difficulties in the utilization of residues are largely associated with their location and availability, inadequate handling facilities, and lack of markets. The following analysis presents information on quantity, kind, source, and location of residues and on the present usage of them.

Logging Residues

Each year a certain amount of standing timber is cut for timber products. In the logging process, some additional trees are knocked down or otherwise killed. Part of the inventory volume that is cut or killed is removed from the woods in the form of logs, bolts, or other round products. Part of that which is cut or killed, however, is left unused in the woods. This is the material designated as "logging residues." The term applies only to material that is taken out of the growing-stock inventory but left in the woods, unused.

Cutting on a given area may be done for a single product or for a number of products, all at the same time or at different times, and by the same operator or different operators. In logging of this sort, certain parts of the felled trees may be utilized for saw logs, and other parts may be selected for veneer and pulpwood. Only the parts finally unused are classed as residues. By way of example, logging residues may include logs missed in yarding or left at landings; pieces resulting from breakage; unutilized portions of trees cut, whether in the boles or tops down to 4 inches in diameter; leftovers in making hewn ties and split products; and growing-stock trees knocked down or otherwise killed during logging and left in the woods.

In addition to the residues from growing stock, there is a large but undetermined volume of other material left on the ground following logging—such as sound cull trees, sound portions of rotten culls, previously dead trees, tops less than 4 inches in diameter, and limbs. Thus, while this study deals only with logging residues from growing stock, any proposal for possible uses of such residues would apply in certain respects to all classes of material that may be available.

Quantity, Source, and Location of Logging Residues

In 1952, about 1.4 billion cubic feet of logging residues resulted from cutting for timber products in the United States and Coastal Alaska (table 95, p. 156). This is the equivalent of about 17 million cords, or 70 percent of the total pulpwood output in 1952. Seventy-five percent was attributable to saw-log operations, 7 percent to veneer, and the remaining 18 percent to all other logging and woods operations.

TABLE 105.—*Ratio of net annual growth to timber cut for sawtimber and growing stock in continental United States, 1944 and 1952*

Section and region	Sawtimber				Growing stock			
	Softwood		Hardwood		Softwood		Hardwood	
	1944	1952	1944	1952	1944	1952	1944	1952
North	0.86	1.04	1.47	2.21	0.87	1.17	1.53	3.10
New England	.78	.66	1.38	2.44	.92	.81	1.59	4.22
Middle Atlantic	.83	.92	1.38	2.09	.84	1.20	1.68	3.53
Lake States	.83	2.09	1.25	2.21	.83	1.70	2.07	2.47
Central	1.88	2.93	1.65	2.15	.89	2.71	1.16	2.79
Plains	4.44	3.33	2.17	4.40	.87	2.25	1.25	4.46
South	.91	1.24	.99	1.21	.94	1.17	1.30	1.62
South Atlantic	.90	1.09	1.64	1.61	.95	1.06	1.96	1.74
Southeast	.86	1.17	.81	.91	.91	1.16	1.21	1.45
West Gulf	1.01	1.57	.90	1.34	.99	1.35	1.07	1.77
West	.60	.49	4.31	3.30	.82	.70	10.91	6.48
Pacific Northwest	.41	.41			.51	.53		
Douglas-fir subregion		.41				.47		
Pine subregion		.40				.92		
California	1.06	.51			1.29	.59		
Northern Rocky Mountain	1.31	.79			2.46	1.80		
Southern Rocky Mountain	1.47	1.23			2.12	1.98		
United States	.75	.76	1.19	1.58	.88	.93	1.43	2.21

On the average, about 13 percent of the growing stock cut or killed in logging is left in the woods unused:

Product:	Residues as percent of timber cut
Hewn ties	38
Cooperage logs and bolts	31
Veneer logs and bolts	20
Saw logs	15
Poles	14
Piling	13
Round mine timbers	6
Pulpwood	4
Fuelwood	4
Other	12
Average all products	13

The production of hewn ties is traditionally the most wasteful of all industries. Residues in relation to timber cut are also high (31 percent) in the production of cooperage logs and bolts, chiefly because only the best quality logs are selected from the scattered trees cut for cooperage. Thus, there is little opportunity for salvage of leftovers for other products. Saw-log and veneer operations likewise leave comparatively large volumes of residues in the woods—15 and 20 percent, respectively, of the amount of timber cut for these products. Due to less exacting specifications for such products as pulpwood, fuelwood, mine timbers, and posts, residue volumes are naturally small compared to volume cut.

Although more than half of the total volume of residues incident to logging occurs in the South, the proportion relative to timber cut is not much more there than in other sections of the country.

Section:	Percentage of total logging residues	Residues as percent of timber cut
North	15	11
South	52	14
West and Coastal Alaska	33	12

Utilization appears to be best in New England, where residues constitute only 9 percent of timber cut (table 96, p. 157). It is apparently poorest in California, in that residues there comprise 18 percent of the volume cut—the highest proportion of any region. This is possibly due largely to the high rate of breakage and other difficulties associated with logging the large old-growth redwood and Douglas-fir in the northwestern part of the State. Furthermore, opportunities for integrated logging and relogging are not as good in California as in the Pacific Northwest because the State lacks pulp mills or other industries that could utilize leftovers from saw-log and veneer operations.

Logging residues are widely dispersed at thousands of small logging sites throughout the North and South, but large concentrations occur at relatively few sites in the West. About 80 percent of the logging residues in this section are, in fact, concentrated in the Douglas-fir region and California.

Woods Utilization Improved Since 1944

In 1944, estimates of drain due to cutting for commodities included the limbwood volume in hardwoods. Since limbwood was excluded from the estimates of timber cut in 1952, it is necessary to deduct the volume of hardwood limbs from the 1944 figures to make valid comparisons with timber cut in 1952. On this basis it appears that logging residues in the North represented the same proportion of commodity drain in 1944 as of timber cut in 1952—11 percent. Logging residues in the South were 16 percent of commodity drain in 1944 as compared to 14 percent of timber cut in 1952.

While it is reasonable to suppose that there has been some improvement in utilization in the North since 1944, no radical changes are known. The same is true for the South, although in this section increased demands for pulpwood, and improvements in logging equipment and methods, probably advanced the limits of utilization more than in the North.

The change towards closer utilization in the woods is more pronounced in the West. Here, due to strong demands for lumber, pulp, veneer, and other products, such practices as relogging and integration of logging operations, aided by new and better equipment, have greatly broadened the opportunities for more complete utilization of the timber that is cut.

The 1952 estimate for the West indicates that logging residues amounted to only about 12 percent of the timber cut. The 1944 Reappraisal showed nearly three times this amount, or 34 percent. The 1944 figures, however, included most if not all of the sound material left over from logging without full allowance for (1) cull and breakage deductions normally accounted for in estimating timber volume or (2) material that would not otherwise qualify as growing stock in inventory determinations. If, as a result of these qualifications, logging residues in relation to the cut of growing stock were less by as much as 15 percent in 1944, the change by 1952 would still signify substantial improvement.

Plant Residues

In contrast to logging residues, plant residues include all residues, both coarse and fine, originating in the manufacture of primary forest products, whether used or not, and regardless of whether the logs and bolts were from growing stock or other sources, such as cull and dead trees. Coarse residues consist of slabs, edgings, trimmings, miscuts, cull pieces, veneer cores, and other material suitable for remanufacture or chipping. Fines,

on the other hand, are residues generally too small for chipping, like sawdust, shavings, wood substance lost in barking, chipper rejects at pulp mills, and veneer clippings.

The character, quantity, or quality of these residues may vary broadly from industry to industry and place to place, as may the opportunity to use them. Considerable quantities of all kinds are used as fuel. Lesser amounts are salvaged for pulp, hardboard, or other fiber products, and for a variety of other purposes including agriculture.

Plant residues constitute a very large source of wood. Although about three-fifths of the volume is being used for one purpose or another, there are opportunities for using much that remains and for the use at higher levels of residues now being burned as fuel.

Quantity, Source, and Location of Plant Residues

Estimates of plant residues were developed for all plants engaged in the primary manufacture of logs and bolts in the United States and Coastal Alaska. These plants included lumber mills and integrated planing mills, veneer and plywood plants, pulp mills,[36] cooperage plants, small dimension and turnery plants, shingle mills, chemical and excelsior plants, and similar establishments. In the aggregate, plant residues totaled 3.4 billion cubic feet in 1952 (table 106). This volume, which was divided about evenly between coarse and fine, was equal to about 38 percent of

[36] Plant residues at pulp mills relate only to wood losses in storage and in preparing the wood for pulping. Additional losses of wood substance incurred in the various pulping processes are excluded.

TABLE 106.—*Plant residues in the United States and Coastal Alaska, by kind of material, and by industry source, 1952*

Industry	Total		Coarse	Fine
	Million cu. ft.	*Percent*	*Million cu. ft.*	*Million cu. ft.*
Lumber [1]	2,950	86	1,466	1,484
Veneer	205	6	67	138
Pulp [2]	170	5	82	88
Cooperage	40	1	23	17
Other [3]	49	2	23	26
Total	3,414	100	1,661	1,753

[1] Includes planing mills integrated with sawmills.

[2] Plant residues at pulp mills relate only to wood losses in storage and in preparing the wood for pulping. Additional losses of wood substance incurred in the various pulping processes are excluded.

[3] Includes small dimension and turnery plants, shingle mills, chemical and excelsior plants, and similar establishments utilizing roundwood.

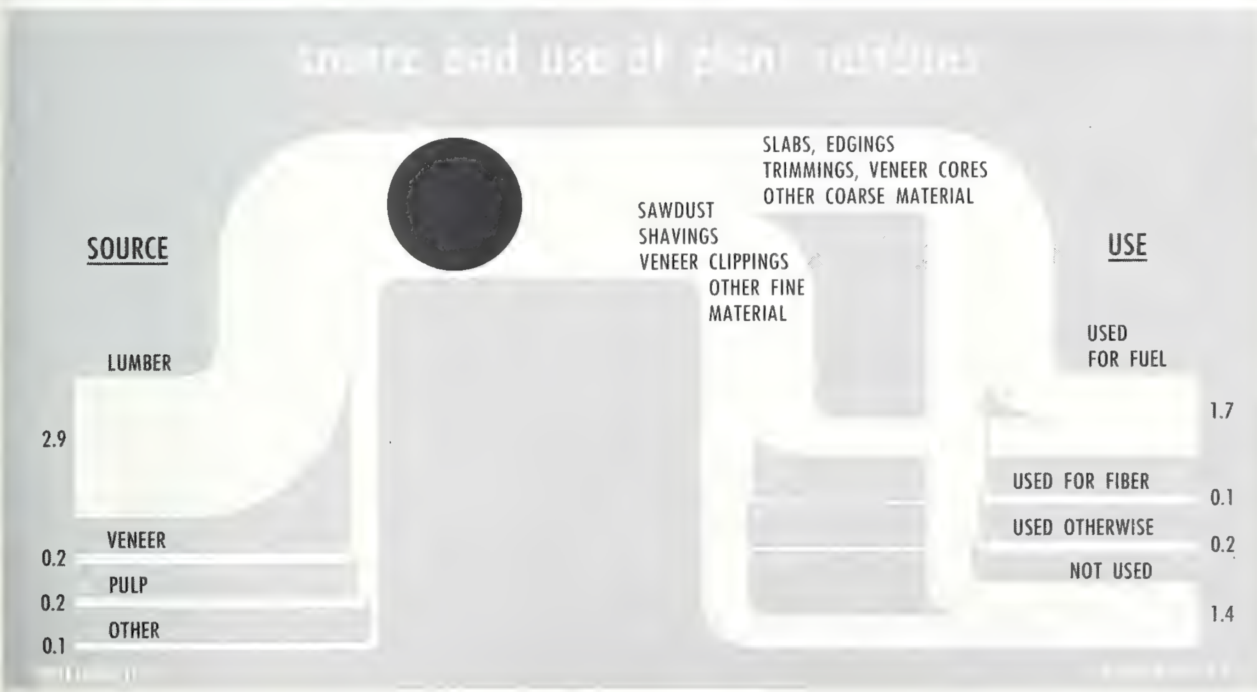


Figure 68

all raw materials entering the plants as logs and bolts. Coarse residues alone were equivalent in volume to the entire cut of growing stock for pulpwood in the United States in 1952.

The great bulk of plant residues is attributable to lumber manufacture. In 1952, about 86 percent of the total volume was found in this industry (table 106 and fig. 68). This is not at all surprising, for sawmills consume nearly three-quarters of all logs and bolts used in primary manufacture and nearly half the saw-log volume ends up as residues. Much the same situation exists in all regions, since the quantity of logs used for lumber in the different regions far exceeds the volume used by other industries. And largely for this reason plant residues are distributed geographically in about the same proportion as sawtimber cut. Thus 43 percent of all plant residues were in the West and Coastal Alaska, 43 percent in the South, and 14 percent in the North (table 107).

Plant Residues in Relation to Input Are Greatest in Cooperage Manufacture, Least in Preparing Wood for Pulping

Although lumber manufacture is responsible for most of the plant residues volume, residue volume as a percent of total roundwood input is not so high as for some other products (table 108). For example, residues in the manufacture of cooperage, because of more exacting quality specifications, are generally greater in relation to the volume of logs and bolts processed than for either lumber or veneer.

At pulp mills, on the other hand, relatively small losses are incurred from the time the pulpwood is received until it is chipped and ready for final processing into pulp. Estimates place these losses at about 7.5 percent of the roundwood

TABLE 107.—*Plant residues in the United States and Coastal Alaska, by kind of material, and by section and region, 1952*

Section and region	Total		Coarse	Fine
	Million cu. ft.	*Percent*	*Million cu. ft.*	*Million cu. ft.*
North:				
New England	126	3. 7	68	58
Middle Atlantic	143	4. 2	79	64
Lake States	110	3. 2	61	49
Central	88	2. 6	54	34
Plains	4	. 1	2	2
Total	471	13. 8	264	207
South:				
South Atlantic	504	14. 8	241	263
Southeast	663	19. 4	299	364
West Gulf	308	9. 0	124	184
Total	1, 475	43. 2	664	811
West:				
Pacific Northwest:				
Douglas-fir subregion	842	24. 7	378	464
Pine subregion	130	3. 8	58	72
Total	972	28. 5	436	536
California	372	10. 9	242	130
Northern Rocky Mountain	81	2. 4	31	50
Southern Rocky Mountain	38	1. 1	21	17
Total	1, 463	42. 9	730	733
Total, United States	3, 409	99. 9	1, 658	1, 751
Coastal Alaska	5	. 1	3	2
United States and Coastal Alaska	3, 414	100. 0	1, 661	1, 753

TABLE 108.—*Plant residues as a proportion of total volume of logs and bolts used in primary manufacture, in United States and Coastal Alaska, by type of industry and section, 1952*

Section	Lumber [1]	Veneer	Pulp [2]	Cooperage	Other [3]	Total
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
North	42. 2	43. 5	10. 1	65. 7	27. 9	28. 5
South	56. 1	50. 3	6. 4	51. 9	22. 0	39. 8
West and Coastal Alaska	43. 3	46. 0	6. 2	10. 6	40. 5	39. 4
United States and Coastal Alaska	47. 9	47. 2	7. 5	54. 5	29. 4	37. 6

[1] Includes planing mills integrated with sawmills.

[2] Plant residues at pulp mills relate only to wood losses in storage and in preparing the wood for pulping. Additional losses of wood substance in the various pulping processes are excluded.

[3] Includes small dimension and turnery plants, shingle mills, chemical and excelsior plants, and similar establishments utilizing roundwood.

volume.[37] Loss of wood substance due to decay in storage is estimated to vary from 2.5 to 3 percent in the South and West to 6 percent in the North. Rejects of fines in screening chips may range from 1 to 5 percent, depending on the pulping process. Wood substance lost in barking is estimated to range from 1 to 2 percent, depending on the method of barking and the use made of the pulp.

Log diameter and mill size are the principal variables affecting residues in lumber manufacture. Comparatively more residues result in sawing small logs than large, whether in large or small mills, simply because a larger share of the log volume is represented in slabs, edgings and sawdust. Large mills, however, are generally equipped for more efficient sawing and machine operation than small mills are. Small mills and small timber most often go together. Both are characteristic of the North and South. Large mills, on the other hand, are more characteristic of the West, where large timber is still found in abundance.

In addition to log size, log quality and type of product affect the amount of residue in veneer manufacture. Good veneer timber has become scarce in all sections of the country. As a consequence, trees that would be regarded at the lower margin for saw logs are used to an increasing extent for lower grade plywood and containers. Under these conditions, more of the log winds up as residues despite efforts to save as much as possible in the form of usable veneer by patching and using the poorest material for cores or backing in plywood, or for containers.

Residues in relation to log input for lumber and veneer are highest in the South (table 108). With respect to lumber this may be attributed in part to the preponderance of small softwood logs in the cut, and in part to the poor sawing practices prevalent at many of the thousands of small mills which predominate in the area. In the West, of course, residues represent a smaller share of the log volume because larger timber is being cut. The difference between the North and South is perhaps due to the fact that the hardwoods that make up the bulk of the cut in the North average somewhat larger than the general run of softwoods cut in the South.

Residue percentages in veneer manufacture are higher in the South than in the West, largely because southern veneer plants subsist on much smaller and poorer quality logs than do western plants. Residues from veneer manufacture in the South are also somewhat higher than in the North. This difference appears to be significant but is difficult to rationalize. The higher percentage in the South may reflect the greater use of relatively poor quality logs for container veneer, a product which makes up more of the veneer output in the South than in the North. These logs generally yield a greater percentage of residues than do the better quality logs used for commercial and utility grades and face veneers.

Residue percentages are substantially higher in pulp and cooperage manufacture in the North than elsewhere. For pulp, this reflects the longer storage period and consequent greater storage losses, and for cooperage it denotes poorer average quality of the material cut.

Use of Plant Residues

In 1952, about three-fifths of the total volume of plant residues was used (fig. 69). About one-half of the used residues were coarse and one-half fine. Residues have long been burned for domestic and industrial fuel. In 1952, fuel took 1.7 billion cubic feet, or 86 percent of all the residues used (table 109). Put another way, the amount used for fuel is the equivalent of about 31.5 million cords, or more than half of the total fuelwood output from all sources. Probably as much as 60 percent of the coarse residues burned for fuel are used for domestic purposes whereas most of the fines are burned at industrial plants. Rural areas, such as are common in much of the South, Midwest, and Southwest, account for a high percentage of the domestic wood used in the form of slabs and similar coarse residues. On the other hand, industrial use is generally associated with large sawmills and veneer plants where large quantities are directly available. These residues frequently present a severe disposal problem, and often provide the most economical fuel where steam and heating requirements are large. This is the situation at many of the large plants in the West.

Although plant residues are used mostly for fuel, they have not gone entirely unnoticed for other purposes. About 5 percent of the total used volume, for example, was for pulp and 9 percent for a variety of other uses including agriculture (table 109). Other than fuel and pulp, coarse residues were made into cut-up stock, handles, brush blocks, chemical wood, boxboard, lath, fence pickets, particle boards, and many other commodities. Fines, though going mainly into fuel, were also used in various other ways. Some veneer clippings were pulped. Considerably more fines went into mulches and soil conditioners, bedding for livestock, poultry litter, insulation, wood flour, linoleum filler, metallurgical use, and a wide assortment of other applications.

[37] Aside from these residues, it is estimated that an additional 40 percent of the wood used by all processes of pulping in 1952 was dissolved in the various pulping liquors or the water used for washing and conveying the pulp. About 80 percent of the dissolved material was recovered and used as fuel or for a variety of byproducts.

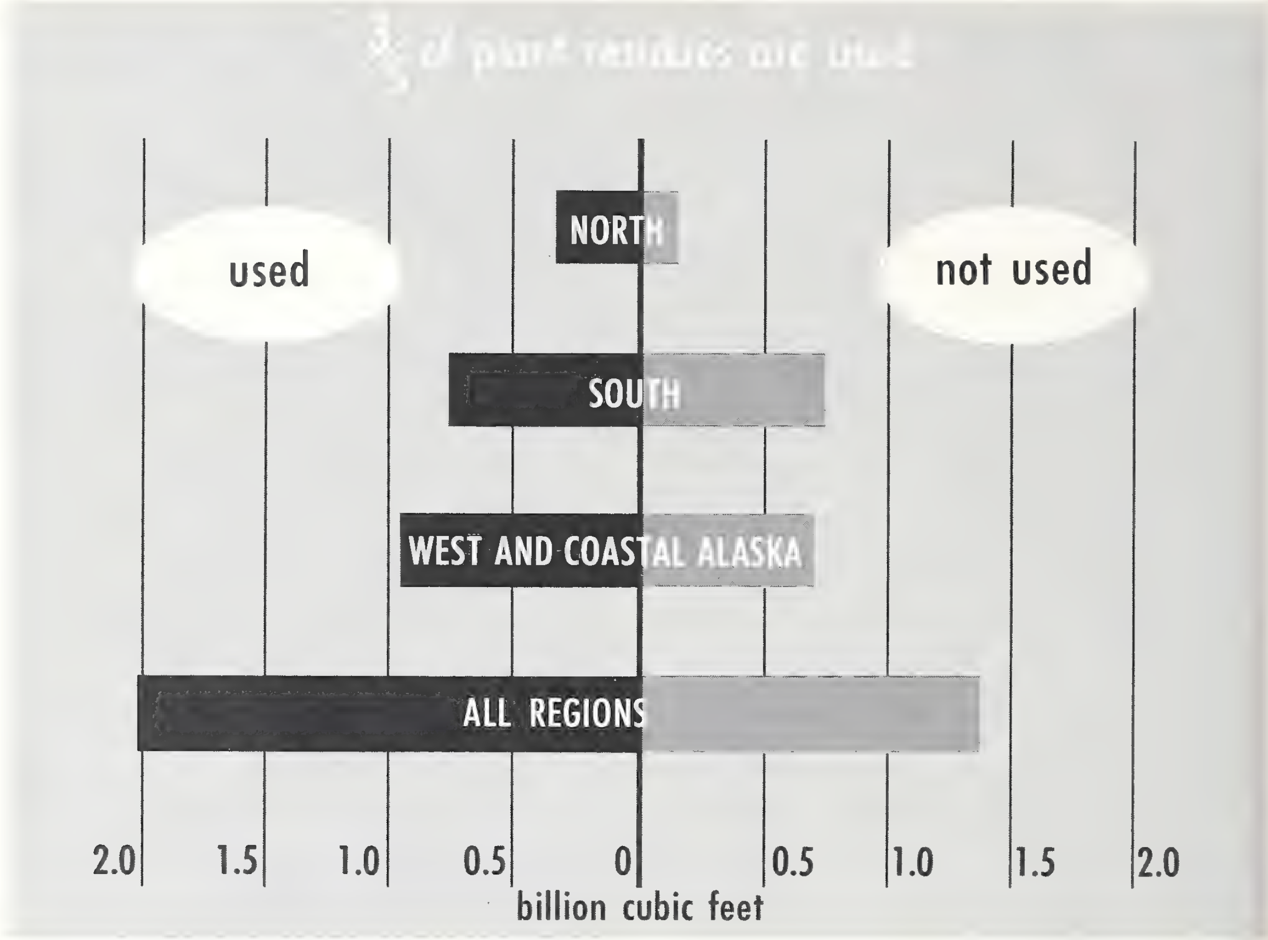


Figure 69

TABLE 109.—*Use of plant residues in the United States and Coastal Alaska, by kind of material and type of use, 1952*

Kind of material	Total residues	Residues used for—				Residue not used
		Fuel	Fiber	Other [1]	Total	
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Coarse	1, 661	826	91	69	986	675
Fine	1, 753	926	19	101	1, 046	707
Total	3, 414	1, 752	110	170	2, 032	1, 382

[1] Includes material for cut stock, handles, brush blocks, chemical wood, boxboard, particle board, floor-cleaning compound, wood flour, insulation, bedding for livestock, poultry litter, soil conditioner, metallurgical use, and similar purposes.

The use of plant residues for pulp is fairly new. Ten years ago there was little chipping of plant residues for pulp. In 1952, however, the equivalent of about 1.2 million cords, or 30 percent of the pulpwood output in the Pacific Northwest, came from this source. Residues for pulp had likewise gained in the South and North. All together about 6 percent of the total pulpwood output in the United States is derived from plant residues, mostly slabs, edgings, other coarse sawmill residues and veneer cores. In addition to pulp, practically all the raw material to supply the recent large expansion of the hardboard industry in the West consists of sawmill and plywood residues.

In lumber manufacture, about 55 percent of the residues are used (table 110). The percentage is considerably higher in other industries that have better outlets for residues or can use them to better advantage for fuel. Thus practically all of the veneer and pulp mill residues are used.[38] In cooperage plants and other mills and plants like bolting mills, shingle mills, box plants, excelsior plants, and turnery and dimension plants, about 70 percent of the residues are used.

TABLE 110.—*Use of plant residues in the United States and Coastal Alaska, by industry source and type of use, 1952*

Industry	Use				Relation of used residues to total residues
	Fuel	Fiber	Other[1]	Total	
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Percent*
Lumber [2]	1,397	76	146	1,619	55
Veneer	131	34	15	180	88
Pulp [3]	170			170	100
Cooperage	25		2	27	67
Other [4]	29	([5])	7	36	73
Total	1,752	110	170	2,032	60

[1] Includes material for cut stock, handles, brush blocks, chemical wood, boxboard, particle board, floor-cleaning compound, wood flour, insulation, bedding for livestock, poultry litter, soil conditioner, metallurgical use, and similar purposes.

[2] Includes planing mills integrated with sawmills.

[3] Plant residues at pulp mills relate only to wood losses in storage and in preparing the wood for pulping. Additional losses of wood substance incurred in the various pulping processes are excluded.

[4] Includes small dimension and turnery plants, shingle mills, chemical and excelsior plants, and similar establishments utilizing roundwood.

[5] Less than 0.5 million cubic feet.

[38] Unlike residues resulting from other types of primary manufacture, residues in preparing wood for pulping have little or no particular use other than fuel.

Because of the greater number of large plants in the West and the greater population density and better developed outlets in the North, utilization of residues is comparatively higher in these sections than in the South (table 111). These apparent advantages are the principal reasons why 88 percent of the residues used for pulp are in the West and 44 percent of the utilized residues other than those that go into fuel and pulp are in the North. Log barkers and chippers now fast coming into use in the South will, however, boost the total of residues used for pulp in that section.

Unused Residues Can Help Meet Additional Needs for Timber Products

Greater use of plant residues could mean large savings of growing stock. Except for fuel, the surface has hardly been scratched and much that is used for fuel could possibly be put to better use. Unused residues, therefore, would seem to offer substantial opportunities to meet additional needs for products like pulp, hardboard, small dimension, and miscellaneous items without commensurate demands on growing stock.

About 1.4 billion cubic feet, or two-fifths of all plant residues, are unused (table 112). This volume is roughly the equivalent of about 12 million cords, or more than the entire volume of fuelwood cut from growing stock in 1952.

TABLE 111.—*Use of plant residues in the United States and Coastal Alaska, by section and type of use, 1952*

Section	Use				Relation of used residues to total residues
	Fuel	Fiber	Other[1]	Total	
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Percent*
North	252	2	74	328	70
South	702	12	44	758	51
West	795	96	52	943	64
Total, United States	1,749	110	170	2,029	60
Coastal Alaska	3		([2])	3	48
United States and Coastal Alaska	1,752	110	170	2,032	60

[1] Includes material for cut stock, handles, brush blocks, chemical wood, boxboard, particle board, floor-cleaning compound, wood flour, insulation, bedding for livestock, poultry litter, soil conditioner, metallurgical use, and similar purposes.

[2] Less than 0.5 million cubic feet.

About 52 percent of total unused residues are in the South, 38 percent in the West, and 10 percent in the North. Since practically the entire volume results from lumber manufacture, much that is in the South and North is scattered among thousands of small mills. In the West, residues are mainly at large mills in the Douglas-fir subregion and in California.

TABLE 112.—*Unused plant residues in the United States and Coastal Alaska, by kind of material and by section and region, 1952*

Section and region	Coarse	Fine	Total
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*
North:			
New England	25	18	43
Middle Atlantic	25	27	52
Lake States	5	17	22
Central	13	11	24
Plains	1	1	2
Total	69	74	143
South:			
South Atlantic	109	151	260
Southeast	146	205	351
West Gulf	44	61	105
Total	299	417	716
West:			
Pacific Northwest:			
Douglas-fir subregion	111	115	226
Pine subregion	9	10	19
Total	120	125	245
California	162	66	228
Northern Rocky Mountains	15	15	30
Southern Rocky Mountains	8	9	17
Total	305	215	520
United States	673	706	1, 379
Coastal Alaska	2	1	3
United States and Coastal Alaska	675	707	1, 382

Plant residues are in a large measure unavoidable in all types of primary manufacture even with the most modern equipment. Their utilization is complicated by many factors. The lack of markets is a chief hindrance. And even if markets exist, residues must be available cheaply and in sufficient quantity; otherwise potential users may not find it profitable to use them. Most markets are specialized and very often local or regional in character. Thus large concentrations such as are found in the West may offer the best opportunities for economic use.

Despite reasonably good current use of plant residues, there remains the problem of finding profitable ways of using more of them. In some cases this may mean finding new uses for residues. In other instances it may mean the development of new markets for products that are presently derived from residues.

TRENDS IN UTILIZATION

Failure to get maximum use from the Nation's timber resources has been a matter of growing concern for many years. Fuller use has become increasingly vital in the face of diminishing supplies and expanding requirements for domestic timber. Much has been done about it in the past, and recent developments promise still greater improvement in the future.

Better and more complete utilization in the woods and in the conversion processes is largely activated by economics. The equipment, machines, techniques, and new processes and products by which better utilization can be accomplished are mostly the results of research and of industrial experimentation and development. Improvements in equipment and methods which have taken place over the years in the interest of lowering production costs have in turn contributed to better utilization by making more of the raw material profitable to handle. Advances in utilization have been further stimulated by expanding markets, tightening supplies, higher stumpage and log prices, changes in labor and equipment costs, and other economic considerations. New uses for wood and improvements in primary manufacturing processes and the establishment of more pulp mills and other wood-using industries have also influenced the trend by creating markets for material previously left in the woods or unused at the mills.

Research in forest products utilization can be credited with substantial contributions toward better and more efficient wood use during recent years. Pulping processes have been developed which give higher yields per cord of wood and which use a wide variety of "weed" and little-used species; log grading systems have been, and are being, devised and tested as tools for product segregation of logs; many devices and techniques have been developed for the more efficient operation of small sawmills; the machining properties of many species have been tested, together with the preferred machining methods; and methods of modifying wood properties have been found, thus creating new markets.

Much information has been developed on the engineering, container, and structural uses for wood, resulting in improved structures and products with more economical use of timber; glues, gluing, laminating, and sandwich construction studies have resulted in better service, new markets, and increased wood-use economy; air-seasoning and kiln-drying studies have been responsible for superior wood products with decreased degrade and waste; the development of

preservatives and treating methods has greatly extended the life of wood in outdoor service, thus reducing replacement requirements; and fundamental studies in wood properties, wood structure, wood chemistry, and wood physics have developed a background for many more utilization advances.

Utilization in the Woods

Improved Equipment and Logging Methods

Changes in equipment and methods of logging have been responsible for a large part of the progress made in utilizing material in the woods. Fast-working, labor-saving equipment for cutting, skidding, loading, transporting, and road building has steadily broadened the limits of profitable logging—including better use of defective material, salvage logging following the main operation, and greater integration of logging operations wherein parts of trees, suitable for different products, are distributed to the industries that can use them to the best advantage.

Felling and bucking have become largely mechanized. Chain saws, now widely used throughout the country for felling and bucking, and power-operated circular saws now prominent in southern logging operations, have greatly increased output per man at generally lower costs. In 1950 about 70 percent of the felling and bucking operations in the lumber and pulp industries and about 60 percent in the veneer industry were performed with power saws. Power saws have brought about certain improvements in utilization such as lower stumps, greater use of tops, and increased use of sound material in otherwise cull logs.

Skidding is now done largely with tractors, rather than cable-yarding engines. Because tractors permit greater flexibility in logging, material considered too costly to operate with various forms of cable yarding can often be handled economically with tractors. And, when handled properly, tractors are also less damaging to residual timber or down timber. Tractor yarding accounted for 55 percent of the total yarding job in the lumber industry in 1950, 48 percent in the veneer industry, and about one-third in the pulpwood and other industries.

Other woods practices such as yarding full tree lengths to a central point for bucking and package handling of logs and bolts, particularly in relogging cutover areas, have been stimulated by the development of suitable equipment.

Loading is now done faster, more easily, and more cheaply with mobile power equipment, thus broadening the range of profitability for material previously passed up. The job of transporting logs and bolts has also undergone development. Motortruck hauling has become so efficient that it is fast replacing the logging railroad even in the West. In 1950, considering both distance and volume transported, it was estimated that about two-thirds of the total job of hauling saw logs, 70 percent of the total for veneer logs and bolts, and 40 percent of the total job of hauling pulpwood was done by truck. Probably most of the logs and bolts that eventually arrived at mill sites by rail or water were transported part way by truck.

The shift from rail to truck has been greatly accelerated by continued improvements in motortrucks, by the construction of public motor highways, and by the bulldozer, the tractor grader, and other equipment for building low-cost woods roads. Truck hauling and low-cost roads have in turn opened up remote timber and the more scattered stands to profitable logging and have increased the opportunities for greater salvage of dead trees and other material formerly considered too costly to handle.

Expanding Markets

Expanding markets for pulp and other forest products have made it possible to take from the woods much previously unsalable material, thus lessening the impact on growing stock. Dead and cull trees and trees from noncommercial forest land form an increasingly large proportion of the cut for lumber, veneer, pulp, fuelwood, posts, mine timbers, and various miscellaneous products. And tops of felled trees, broken and cull pieces, and other material previously left in the woods are marketable to an increasing extent for such products as pulpwood, fuelwood, posts, and mine timbers. Currently about 12 percent of the pulpwood in the South is derived from tops left after logging for other products.

Shortages Force Better Utilization of Veneer Timber

The veneer and plywood industry offers a particularly fine example of technological adjustment to a changing resource. When quality timber was more plentiful, only the large clear logs were sought for veneer. But as competition developed for quality timber and demands for veneer and plywood increased, specifications had to be correspondingly lowered. Thirty inches used to be the minimum diameter for softwood veneer logs and these logs had to be clear. Now logs as small as 18 inches in diameter and with many defects are used. Sound sections of cull trees are also salvaged.

Smaller logs also are used for hardwood veneer, often only 12 to 15 inches in diameter, and as small as 9 inches for some products. Slices are used to an increasing extent as a means of utilizing

species that, because of irregular grain, splits, stresses, and brash centers, cannot be handled well on the lathe.

Utilization of Plant Residues

Improvement in handling and processing equipment, increasing demands for pulp and other products, the creation of new markets and uses for wood, have tended to increase the utilization of plant residues.

During the past few years, pulp mills have made increasing use of the slabs, edgings, and trim discarded at sawmills; and the hardboard industry, particularly in the West, has based its expansion almost entirely on this kind of material. As only limited amounts of bark can be tolerated, there has been increasing use of mechanical and hydraulic barkers to remove the bark from logs as they enter the mills or for later barking of the slabs themselves. While most of the residues used for pulp and hardboard come from the larger mills, some progress is being made in the utilization of slabs and other coarse residues at small centers of concentration through the development of portable chippers and improved equipment for faster and easier handling.

Veneer cores, already bark free, have become especially attractive for pulp, and their use for this purpose has grown steadily. A similar use has developed for veneer clippings, particularly on the West Coast, where supplies are plentiful and cheap.

While the growing use of residues for pulp is perhaps the most spectacular, other uses for plant residues have likewise expanded considerably in recent years because of growing markets and scarce timber supplies. Greater quantities of sawmill and other coarse plant residues, for example, are being diverted for remanufacture. The development of processes and markets for fine residues like sawdust and shavings has opened up opportunities for better and more complete utilization of these residues.

Not to be overlooked is the progress made in the use of both coarse and fine residues for charcoal and a wide assortment of other derivatives developed in carbonization, extraction, hydrolysis, or other chemical utilization processes. There has also been a definite trend towards integration of industries where the residues of one become the raw material for another. Thus through reduced raw-material costs, utilization of residues has become a more profitable undertaking.

The Utilization Outlook

Full economic use of the entire volume of woods and plant residues may never be possible. Yet in building up the Nation's timber supply to meet the ever-increasing demands of the future, advantage must be taken of every possible opportunity to make the timber we have go further. Recent progress is evidence that many of the problems of finding profitable ways of doing this are being overcome. The outlook is for continued improvement.

Some of the improvement is expected to result from closer utilization of growing stock in the woods with a consequent reduction of logging residues, some through reduction in amount of plant residues due to better sawing and other manufacturing practices and more complete utilization of plant residues, and some through greater use of dead and cull trees. Greater integration of the timber products industries, both in the woods and mill, is likewise expected to accomplish more complete and advantageous utilization of the timber that is cut or should be cut. And the practice of relogging cutover areas should gain momentum as better and more suitable equipment for handling and transporting the material economically is developed, and as small portable sawmills are employed to a greater extent to process the leftovers on previously logged areas in the West.

Present trends and anticipated progress in utilization indicate an overall reduction of about 4 percent by 1975 in growing stock needed for a given level of output of all products combined. In other words, the total output which required the cutting of 100 cubic feet of growing stock in 1952 will require cutting only 96 cubic feet in 1975. Whereas only an improvement of 2 percent seems to be a reasonable expectation for lumber, about a 14-percent improvement appears in the offing for pulpwood, since a correspondingly large proportion is certain to come from plant residues, tops, and dead and cull trees.

This trend in the use of plant residues for pulp very probably denotes the largest gains in utilization that can be foreseen. More practicable log and slab barkers will undoubtedly be developed which will greatly extend the market possibilities for use of coarse sawmill residues for pulp and various types of hardboard. And better and more efficient equipment for handling residues and portable chippers now in the development stage may be expected to substantially increase the market potentials for residues from small and widely scattered concentrations.

In addition to pulp, the use of plant residues in remanufacture, in agriculture, and in chemical utilization may be expected to grow in response to continuing market demands, and as competition for the available timber becomes more acute. In this connection it seems reasonable that, as markets and prices improve, much of the residue volume that is now used for fuel will be sought for pulp or put to other more advantageous uses.

CONCLUSION

The Situation With Respect to Timber Growth and Utilization Has Improved

The situation with respect to growth and utilization of timber is better than at any previous time. The most encouraging signs are (1) the estimated 9-percent increase in net annual growth of sawtimber, 1952 over 1944, and the 14-percent increase in the growth of growing stock; (2) the 20-percent excess of growth over cut of eastern softwood sawtimber, largely due to favorable growth-cut ratios in the southern yellow pines; and (3) improved utilization in both woods and mills, thus making the available timber supplies go further.

Overall growth-cut relations in themselves are believed to be misleading. For one thing, they tend to camouflage the often quite different hardwood and softwood comparisons. Likewise, the significance of overall comparisons is distorted by the inclusion of the growth-cut situation in the West, where there is still a large volume of old-growth timber. Finally, a balance of overall growth and cut at existing levels has relatively little significance when it is considered that future demands will entail a need for substantially greater growth than at present. In other words, the level at which such balance occurs is more important than whether a balance has been achieved. Nevertheless, the 20-percent excess of eastern softwood sawtimber growth over cut in 1952 as contrasted to a 10-percent growth deficit in 1944 should be recognized as an important gain.

Growth of growing stock in 1952 was 33 percent in excess of cut. This is a natural accompaniment of the near-balance for sawtimber with the present pattern of products cut. So long as most of the cut is taken from trees 12 inches or more in diameter, whereas annual growth is spread rather uniformly among all size classes, an excess of growing-stock growth will appear when sawtimber growth and cut are in balance.

Sawtimber cut was 2 percent lower in 1952 than in 1944 although the output of lumber, pulpwood, and veneer logs was greater than at any time in 25 years. Some of the increased output of lumber, pulpwood, and veneer logs was offset by a decline in the timber cut for fuelwood, hewn ties, and other products. But timber cut was also held down by better utilization in both woods and mills. In addition, 15 percent of the total output came from dead and cull trees and other material not in the growing-stock inventory. Half of the fuelwood and 6 percent of the pulpwood output was obtained from plant residues and so did not add to timber cut.

Since 1944, ratios of growth to cut of both eastern softwoods and hardwoods have shown marked improvement—from 0.90 in 1944 for softwoods to 1.20 in 1952, and for hardwoods 1.19 in 1944 as compared to 1.57 in 1952. The favorable growth trends for softwoods in the East must be tempered by the realization that the improvement reflects a decline in timber cut as much as it does an increase in growth. However, the improvement is recognized as an encouraging sign and as a reflection of the intensification of forestry effort in recent years. Such progress holds promise for the future.

In the West, growth-cut relations were less favorable in 1952 than in 1944, reflecting the combined effects of a 20-percent rise in cut and a 3-percent drop in growth due probably to accelerated cutting of second-growth softwood stands and abnormally heavy insect losses in the Northern Rocky Mountain Region in 1952. The adverse trend represents a setback inasmuch as growth should increase as the old-growth stands are cut and replaced by more vigorous second growth.

Distribution of Growth and Cut Is Not Well Balanced

Although evidence such as has been cited in the preceding paragraphs makes it clear that the overall situation as to growth and utilization of timber has improved, it is important to recognize certain qualifications.

Proportion of Hardwood and of Inferior Species Increasing

Most important perhaps is the evidence that composition and quality of annual growth and timber cut are not well balanced. Only 25 percent of the cut is from hardwoods, but these species make up 41 percent of the growth. Such an imbalance will almost certainly mean an increasing proportion of hardwoods in our future timber inventory. Accumulation of hardwoods while softwoods have difficulty holding their own looms as a great challenge to the technology of wood utilization.

The problem of composition and quality of annual growth and of timber used reaches beyond the general distinction between hardwoods and softwoods. The more favored species of both hardwoods and softwoods are more heavily cut than the less favored species. In the East, for example, such species as white and red pine are more heavily cut than the less desirable hemlock and larch, and yellow-poplar is cut more heavily than other soft hardwoods like sweetgum, tupelo, and blackgum. Hence, the latter are increasing at the expense of the former.

Heavy Reliance Placed on Small Group of Species

Five leading species, or species groups, consisting of southern yellow pine, Douglas-fir, ponderosa

and Jeffrey pine, western true firs, and the oaks comprise the foundation of our timber supplies. In terms of both sawtimber and growing stock, these species taken together represent a greater proportion of total cut than they do of either growth or volume. In terms of sawtimber, they account for nearly 70 percent of the total cut as compared to about 60 percent of the volume and growth. In terms of growing stock, the proportions are only slightly different—two-thirds of the cut and about half the volume and growth.

Different species show significant variations. The southern yellow pines, for example, have only 8 percent of sawtimber volume but supply one-fourth of the cut and 30 percent of the growth. Douglas-fir, on the other hand, with one-fourth of the volume, likewise contributes one-fourth of the cut but only 9 percent of the growth.

In terms of growing stock, southern yellow pine with 9 percent of the volume accounts for about a quarter of both growth and cut; Douglas-fir has 19 percent of the volume, 18 percent of the cut, and 6 percent of the growth; while the oaks with 10 percent of the volume have 12 percent of the cut and 17 percent of the growth.

The West's share of total sawtimber cut has grown in recent years—from 34 percent in 1936 and 38 percent in 1944 to 46 percent in 1952. The relative dependence on the West may continue for a number of years but not indefinitely. Future output will be more nearly proportional to the area of commercial forest land and to its growth capacity.

Large Opportunities for Fuller and Better Use

There are large opportunities for fuller and better use of the timber we grow. Perhaps the most obvious is the reduction of losses from fire, insects, disease, and other causes. These losses amounted to 12.5 billion board-feet in 1952. They are deducted from gross growth in the computation of net annual growth. Thus, whatever reduction of mortality can be accomplished by more complete protection and by better forest management adds directly to the net annual growth available for use.

Other opportunities can be visualized by study of the elements of input and output in the timber economy (fig. 70). The timber input totaled 13.6 billion cubic feet. In this total were imports, chiefly pulp and paper products and softwood lumber, with roundwood equivalent of 1.1 billion cubic feet. The chart indicates that only 52 percent of the total timber input finds its way into products other than fuelwood. Another 28 percent is used for fuel, much of it in the wood-conversion plants themselves. Twenty percent of the input, about equally divided between logging and mill residues, is not used at all:

	Source o input (percent)
Timber cut from growing stock:	
Softwood	55. 0
Hardwood	24. 0
Total	79. 0
Cut from dead and cull trees [1]	12. 5
Import equivalent	8. 5
Total	100. 0

	Disposition of input (percent)
Lumber	25. 5
Pulpwood	19. 3
Other	7. 5
Total	52. 3
Fuelwood	27. 6
Unused:	
Logging residues	10. 0
Plant residues	10. 1
Total	100. 0

[1] Includes commercial species under 5.0 inches d. b. h., tops under 4.0 inches, and trees from noncommercial and nonforest land.

There is a large opportunity in greater use of salvable dead and cull trees, the volume of which was estimated as 65 billion cubic feet in 1952. In that year, only 1.7 billion board-feet of such timber was cut for use. Use of such trees reduces the drain upon growing stock and so tends to improve the relation of annual growth to timber cut.

Other opportunities lie in more complete utilization of the timber cut. Logging residues amounted to 1.4 billion cubic feet, or 13 percent of the timber cut from growing stock in 1952. This is equivalent to 70 percent of the country's pulpwood output. Much of it is suitable for pulpwood and will be so used if technology can work out the economics of its collection and delivery to the pulp mills.

Plant residues, chiefly at sawmills, offer additional opportunities. These residues amounted to 3.4 billion cubic feet in 1952—38 percent of all raw materials entering the plants as logs and bolts and 25 percent of the total timber input including net imports of lumber and of pulpwood and pulpwood-equivalent of woodpulp and paper. Although 60 percent of the plant residues are now used, only 14 percent are for purposes other than fuel. Unused plant residues comprise a greater volume than all the timber cut for fuelwood.

Better markets, introduction of new timber products, and development of new equipment for

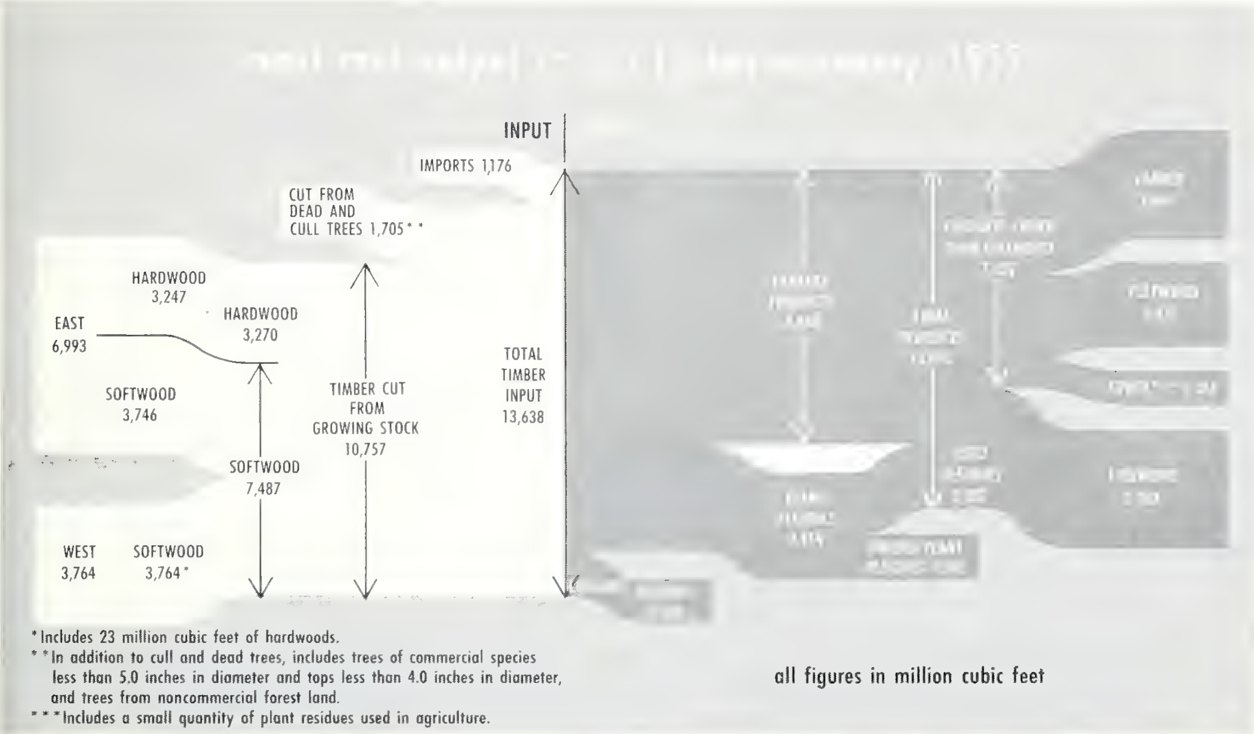


Figure 70

harvesting and processing all make possible fuller and better timber use. Progress in each of these fields will help in meeting future timber needs.

What has been said about increasing use of woods and plant residues has significance chiefly with respect to the softwoods which present the most critical supply problem. Such considerations are of secondary importance for hardwoods. With hardwoods the problem is not primarily supply, but rather demand.

The challenge of underutilization of hardwoods is perhaps the major issue brought out by the analyses of growth, cut, and use. Hardwood volume is accumulating and annual growth of hardwoods is increasing. Yet hardwood cut has fallen off since the end of World War II. Hardwood forest types comprise more than half the total commercial forest area. They are expanding at the expense of softwood types. The excess of annual growth over cut for hardwoods is of little consequence when there is so little evidence that a more abundant supply will bring forth commensurate increase in demand. Fuller utilization of hardwoods should help to take the pressure off the softwoods.

Forest Protection

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CONTENTS

FOREST PROTECTION[39]

George H. Hepting
George M. Jemison

INTRODUCTION

A considerable part of the timber volume added annually by growth to forests of the United States is destroyed by fire, insects, disease, animals, and adverse weather. In addition to the timber destroyed, growth is reduced, quality is impaired, land is left understocked, and other damage is sustained from these forest enemies. These losses are great but history shows us that, in addition, occasional catastrophic losses may be compounded upon our relatively normal losses. Therefore, future growth estimates must allow for probable future losses. To the extent that the damage by destructive natural agencies can be reduced, the available supply of timber will be correspondingly increased.

The purpose of this report is (1) to present and compare the impact of fire, insects, disease, and other destructive events in 1952 on timber growth; (2) to describe the types of damage by different destructive agents and their relative importance; (3) to analyze the status of efforts to reduce these losses; and (4) to appraise, in general terms, the extent to which losses may be reduced in the future.

The Basis for Evaluating Timber Destruction

There are many ways in which destructive agencies affect growth. All of them discussed herein, namely fire, insects, disease, animals, and weather effects, can kill trees. In addition, fires wound trees, laying them open to wood borers and infection by heart rot fungi; or devitalize them, making them prey to bark beetles. Fires are a major cause of understocking and can also deteriorate sites. Such deterioration leads to inferior species composition and reduced growth of the more useful species.

Besides killing trees, insects and disease cause many other types of damage. They destroy seeds and young seedlings, deform and stunt saplings and poles, reduce growth by killing foliage, and eat out the wood of large trees. Animals also cause many types of damage, and everyone is familiar with the destruction resulting from certain caprices of weather—blowdowns, ice and snow damage, flooding and drought.

Growth Impact—the Concept and Definition

In attributing losses and damage to various agencies, a major effort has been made to reflect their full impact on growth as well as to recognize mortality. The preponderance of damage from certain agencies is due to losses in growth rather than mortality. Such is true of the injury caused by the defoliating insects and the heart rots, or the setback in growth from restocking failures or delays following a fire. It is obvious, then, that any real appraisal of damage must include an evaluation of factors causing a reduction in net growth in addition to volume loss through mortality. This concept of total growth impact is new in that it has not been used heretofore in national appraisals of the timber situation.

Mortality and growth loss—the key elements of growth impact—are defined as follows:

Mortality. The volume removed from the total growing stock or the sawtimber portion of it, through death from natural causes, exclusive of catastrophic losses.

Growth loss. The losses sustained other than mortality. It is comprised of the sum of the following two elements: (1) *Growth deficiency*—the loss due to (*a*) delay in restocking or deficiencies in stocking resulting from a damaging attack or fire, and (*b*) the reduction in growth due to changes in timber type, defoliation, reduction of tree vigor, increase in cull percent, or deterioration of site; and (2) *loss of accumulated growth*—the effect on present and prospective yields, of mortality of trees below the sizes measured: in the case of cubic feet of growing stock, below 5 inches d. b. h.; in the case of board-feet of sawtimber, below the minimum d. b. h. specified for sawtimber.

Growth impact. Mortality plus growth loss.

Although the growth impact figures in this report were computed in various ways depending upon the type of damage, in effect they represent

[39] In addition to the tabular data given in this section, more detailed statistics are presented in the appendix, p. 499.

the average annual losses arising from destructive events if these stabilized each year at the 1952 level of such events.[40] It was not always possible to isolate the damage caused by 1952 attacks of some diseases such as root and heart rots, and many insects. In these cases, mean annual loss is used to represent the loss due to the damage occurring in 1952.

The timber losses due to catastrophic events, discussed later, are not included in any of the growth impact figures. These losses result from highly unpredictable events that are characterized by extremely severe and concentrated damage.

Growth impact data do not include the effects of destructive agencies on the quality of timber. It is known, for example, that roundheaded borers and carpenter worms severely impair the quality of oak in the southern hardwood region and elsewhere. The roundheaded borers, flatheaded borers, and other insects not positively identified cause degrade without killing trees or reducing growth. Other insects and fungi also damage saw logs, pulpwood, and other cut products while still in the woods or while in storage at the mill. Although these losses all have an impact on the timber situation, evaluation of the extent of loss is beyond the scope of this report.

Interrelations of Causal Agencies

In some instances, mortality or growth losses are obviously due to a single cause. For example, a crown fire might wipe out a merchantable stand or kill young trees in a plantation. More often, however, losses may be due to a combination of causes. Therefore, in considering the relative importance of the several destructive agencies, the reader must keep in mind that their effects are interrelated. This interrelationship is particularly significant when the possibilities for control are being evaluated. For instance, reduction of butt rot losses in Appalachian hardwoods might best be achieved through improved fire control, which would cut down the number of basal fire wounds through which decay organisms gain access.

In this report, losses are assigned to the causal agency most directly responsible. For example, one of the more important losses is from heart rots. Much of this rot enters through basal fire wounds, some through tops and branches broken by wind, snow, or ice, and some through basal logging wounds. There is some information for the South from which the proportion of heart rot due to fire wounding could be determined. Even there, however, little information exists for assigning other heart rot losses to weather, logging damage, or similar sources. Hence, the entire loss from heart rots was attributed to disease as the direct cause, rather than to the four or more causes initially responsible for entry of the heart rots.

There are many interrelations. Fire often stimulates insect outbreaks by weakening timber, thus providing breeding places for insects. The Tillamook burn and the Bandon fires in Oregon were followed by major Douglas-fir beetle outbreaks in green timber adjacent to these burns. In turn, insect outbreaks are frequently followed by damaging fires because of the extensive areas of flammable fuels created by the insect attacks. Insects are sometimes the carriers of tree diseases, as in the cases of the Dutch elm disease and the elm phloem necrosis. At other times, insects follow behind disease to complete the destruction.

As already mentioned, windfalls frequently provide a favorable breeding place for insects that emerge and attack surrounding healthy timber. Hundreds of square miles of forests and 5 billion board-feet of Engelmann spruce and lodgepole pine were killed in western Colorado between 1940 and 1951 from an outbreak of Engelmann spruce beetle which generated in a windfall of 1939. The western pine beetle, southern pine beetle, and birch dieback in the Northeast are definitely favored by drought. Lightning-struck pines are frequently attacked by bark beetles, and lightning-struck oaks in Pennsylvania have become oak wilt centers.

Many other similar examples of interrelations could be cited. The complexity and the manner in which causal agencies often work together preclude any other satisfactory system of loss classification than assignment of loss to the agency most directly responsible.

Forest Protection as Analyzed in Past National Appraisals

In the past 25 years, three nationwide timber appraisals have been made, and reports were published in 1933, 1941, and 1946. Each of these reports stressed that protection of forests from fire, insects, disease, and other destructive agencies is necessary if we expect to get full timber production from our forest lands. Each presented statistics to show the magnitude of the losses from the major causes of timber destruction, as an indication of the size of the protection problem.

In all of the previous nationwide appraisals, estimates of timber drain from fire, insects, and disease were confined to the cubic feet, board-feet, and cords of timber actually destroyed. They did not include the amount of loss in current growth from insects and disease or the impact of these agencies on future growth, although these effects were recognized as important. Because this report presents separate data for impact from

[40] For methods used in determining growth impact, including sample calculations of (1) growth loss due to delays in restocking, reduction in vigor, heart rots, and site deterioration, and (2) loss of accumulated growth and adequacy of estimates of growth impact, see *Adequacy of Data,* appendix, p. 649.

fire, disease, insects, animal damage, and weather effects, trends in reducing losses will be easier to measure in the future.

Methods of all agencies reporting fire statistics have been on a systematic and fairly comparable basis for many years. Thus, the nationwide figures on fire occurrence and acreage burned are on a comparable basis in the three timber appraisal reports preceding this one. A review of the estimates of annual timber drain from fire shows a progressive reduction in damage from this cause.

The earlier appraisals reported timber destroyed by insects, disease, wind, and other destructive agencies to be from 3.4 to 3.9 billion board-feet a year, or from 2½ to 4 times the damage from fire. In their earlier appraisals, the estimate of timber destroyed by disease, insects, and windstorms included only epidemic losses not salvaged, and omitted the much greater but unestimated normal losses that continuously occur in the forest. The present appraisal includes not only the epidemic losses but the ordinary losses as well. Because of this change to a more comprehensive and realistic definition of mortality and a stronger base for estimating it, the present appraisal of total mortality from causes other than fire is more than triple that of earlier estimates.

In addition, the damages defined in the concept of growth loss have been added, so that the total growth impact in cubic feet, from destructive events other than fire, is more than nine times that of the mortality loss given in the national timber appraisal of 1946. Through the State by State appraisal of each element of mortality and growth loss, by causal agency and by the major tree species involved, there is no doubt that the growth impact data in this report far more nearly approximate the loss from destructive agencies for a given year than the partial figures on mortality alone presented in past appraisals.

It is emphasized that comparison of losses estimated in 1952 with those previously reported should be made with caution. Fire losses are substantially lower than those cited heretofore, primarily because of the progress made in fire control. However, the fact that fire losses are lower does not lessen the importance of the substantial impact this agent causes. Neither does it imply that any slackening in the effort toward better fire control can be accepted. Moreover, there is strong justification for more effective fire control because of the watershed, grazing, and recreation values involved.

A comparison of past and present figures on timber losses might lead one to the conclusion that no progress has been made in the control of insects, disease, and damage other than that due to fire. Such a conclusion would not be justified, for substantial progress has been made in controlling many of the more serious insect and disease epidemics. Control can be and to some extent is being achieved indirectly through silvicultural measures that remove high-risk trees. Fire has been used effectively to control brown-spot disease in the South. A number of successful direct control projects have been completed throughout the Nation as well.

The differences in scope between losses presented in past reports and in this appraisal make direct comparisons of little value. The conclusion is warranted, however, that a tremendous volume of timber continues to be lost every year by the usual as well as the unusual occurrences of fires and the activities of insects, disease, weather, and other natural agencies. The need for effective forest protection is again emphasized by the evidence given in the present report. The only change is that the size of the problem of reducing the losses or utilizing the timber destroyed by destructive agencies is much greater than had been previously supposed.

THE GROWTH IMPACT OF FOREST DAMAGE OCCURRING IN 1952

Destructive Natural Agencies Take Heavy Timber Toll

The total growth impact from destructive agencies on commercial forest lands of the United States and Coastal Alaska in 1952 is estimated at 11.2 billion cubic feet of growing stock, including 43.8 billion board-feet of sawtimber (table 113). These losses are equal to 92 percent of the net sawtimber growth and 90 percent of the sawtimber cut in 1952. Comparative amounts in billions of board-feet are: total growth impact, 43.8; net growth, 47.4; total cut, 48.8. Such destruction indicates that a combination of better prevention, control, and utilization of loss would go far toward meeting future timber demand.

Of the total impact on sawtimber growth, 45 percent is estimated as due to disease (fig. 71). Insects caused 20 percent of the loss, fire 17 percent, and all other agencies 18 percent. The wood used from dead trees in 1952 was 22 percent of the 1952 mortality to growing stock, which is equivalent to only 7 percent of the total impact.

Fire is generally recognized as the greatest enemy of forests, because of its capacity to destroy timber and other forest values over vast areas in a very short time. Largely because of the protection from fire given most of the forest lands in this country, the loss from fire was lower than that from insects or diseases (table 113).

Insects are charged with having killed the most sawtimber. They accounted for 5,041 million board-feet or 40 percent of the total mortality. They also caused a growth loss of 3,576 million board-feet, so that their total growth impact was 8,617 million board-feet.

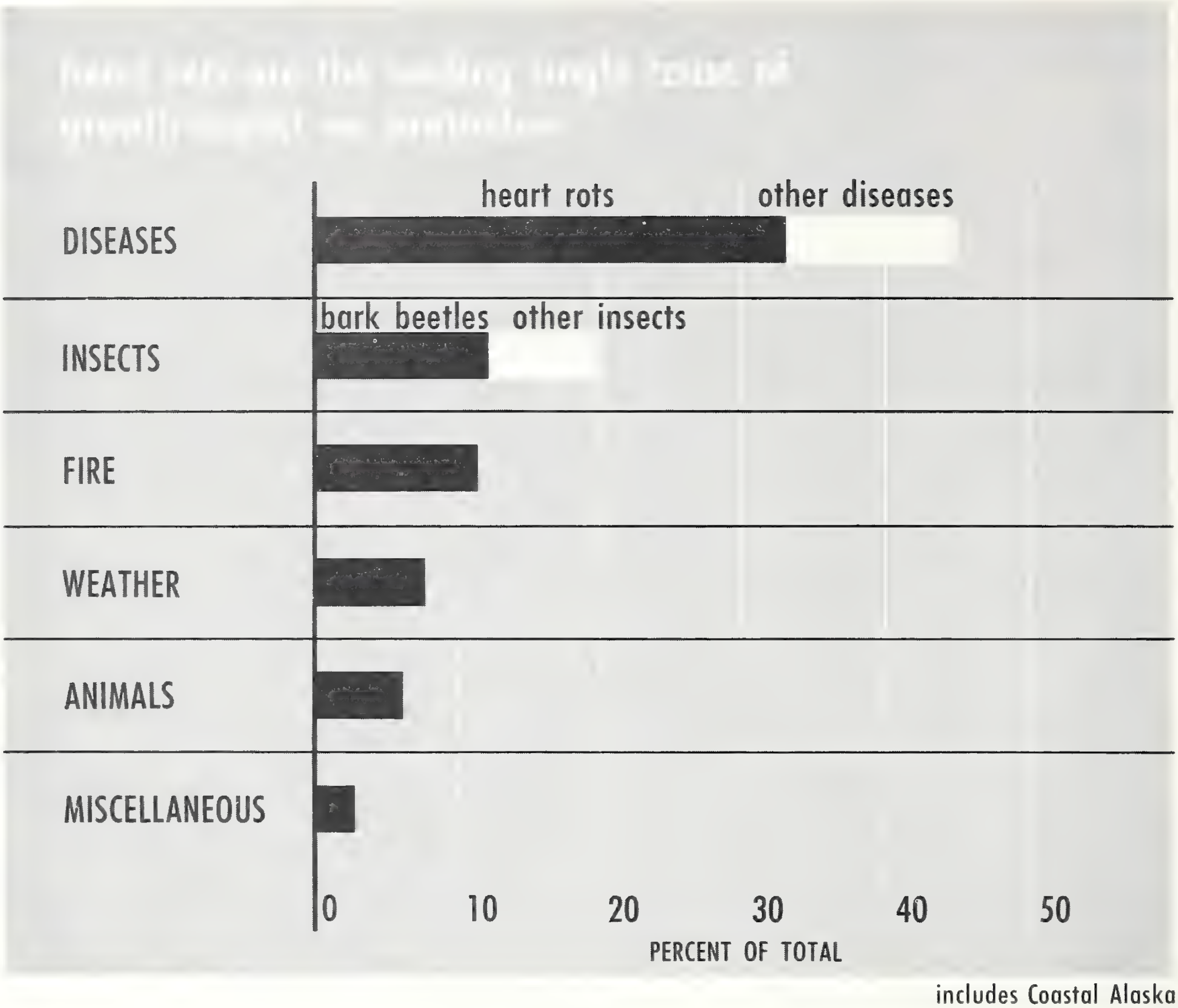

Figure 71

Diseases had their greatest influence on growth loss, largely because of heart rots. Hence in the growth-loss category alone forest diseases accounted for 57 percent of the estimated growth loss in sawtimber from all causes. Because of this high growth loss plus the mortality they caused, diseases accounted for 19,889 million board-feet of growth impact.

Still other causes of loss also loom large in the total effects from destructive agencies, mostly as a result of weather factors, particularly wind, and animal damage. These additional causes of loss made up 18 percent of the total growth impact in terms of sawtimber.

The greatest total losses to sawtimber were in the South, but the North, despite its smaller forest acreage, suffered nearly as much damage. The West was not far behind the North (table 114).

Three regions, the Southeast, the Pacific Northwest, and the Lake States, together made up 47 percent of the total national sawtimber loss (table 115). Disease and fire were primarily responsible in the Southeast, animals and disease in the Lake States, and insects and wind in the Pacific Northwest.

In general, fire had its greatest impact in the South, particularly the Southeast and West Gulf, and in the Central States, and its least impact in the West. Disease impact was greatest in the Southeast and most of the North, but also ran high in most other regions. Insects were worst in the West, particularly the Pacific Northwest, California, and the Northern Rocky Mountain Regions. Animal damage was highest in the Lake and Central States and parts of the South and West, and wind was very damaging in the Pacific

TABLE 113.—*Mortality, growth loss, and growth impact on commercial forest land resulting from 1952 damage, by causes, United States and Coastal Alaska*

GROWING STOCK

Cause	Mortality	Growth loss	Growth impact	
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Percent*
Fire	236	1, 452	1, 688	15
Disease	773	4, 275	5, 048	45
Insects	1, 000	778	1, 778	16
Weather	843	114	957	9
Animals	65	944	1, 009	9
Miscellaneous [1]	593	136	729	6
Total	[2] 3, 510	7, 699	11, 209	--------
Salvage [3]	769	--------	769	--------
Net loss	2, 741	--------	10, 440	--------

SAWTIMBER

Cause	Mortality	Growth loss	Growth impact	
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Percent*
Fire	781	6, 591	7, 372	17
Disease	2, 242	17, 647	19, 889	45
Insects	5, 041	3, 576	8, 617	20
Weather	3, 387	482	3, 869	9
Animals	190	2, 532	2, 722	6
Miscellaneous [1]	1, 026	332	1, 358	3
Total	[2] 12, 667	31, 160	43, 827	--------
Salvage [3]	3, 089	--------	3, 089	--------
Net loss	9, 578	--------	40, 738	--------

[1] Types of damage not ascribed directly to causes listed include suppression, mortality, and growth loss due to logging injury.
[2] These figures represent actual 1952 mortality. They therefore depart somewhat from those in the section Growth and Utilization, p. 145, which represent periodic trend mortality.
[3] Utilized from dead trees in 1952.

Northwest and the Northern Rocky Mountains. The choice of any given base year would affect the regional rankings to some extent, particularly with respect to fire, insects, and wind damage.

Mortality Versus Growth Loss

Growth impact, as previously explained, is made up of mortality and growth loss. Growth loss of sawtimber was about two and one-half times greater than mortality. The relative proportions of mortality and growth loss vary widely between sections (table 116). Forty-eight percent of the growing stock mortality and 69 percent of the sawtimber mortality occurred in the West, while the North and South each contributed less than one-fourth as much as the West to the total sawtimber mortality. By contrast, so much of the growth loss occurred in the North and South that the total growth impact on sawtimber was not greatly different in the three major sections of the country. Coastal Alaska added about 3 percent to the total United States mortality and about 2 percent to the growth loss.

The ratio of mortality to growth loss is very different for the major destructive agencies. As shown in table 115 and figure 72, disease, fire, and animals caused more growth loss than mortality. Insects, weather, and miscellaneous agents caused more mortality than growth loss.

STATUS OF PROTECTION FROM FIRE

Fire Protection in Relation to the Timber Resource

It is thoroughly established and accepted that control of fires is fundamental to the sustained management of forest resources. Fires defeat the objectives sought by forest management; a single blaze can completely wipe out timber values accumulated over many years. If merchantable trees survive fire, their growth rate and quality are often lowered. Fires damage future timber values when they destroy reproduction, saplings, and poles, especially if the burned areas fail to restock naturally.

Fires are largely responsible for the lack of reproduction on the 73 million acres of forest lands now classed as poorly stocked. Fires often set the stage for later attacks by insects and disease. They sometimes result in the replacement of desirable species by less desirable ones, and severe or repeated burning may reduce the productivity of the soil itself. Because of the snags fires create or the highly flammable brush, annual grasses, and weeds that often invade burned areas, efforts to prevent future burns are impeded, sometimes for decades.

The continuous threat of occasional severe losses characterizes the fire problem and the potential impact of fire on the timber resource. Historically we have suffered our greatest losses from the infrequent bad fire, an excessive number of fires in a short period, or a generally severe fire season. The Peshtigo fire in 1871 in Wisconsin burned 1,280,000 acres and 1,500 people lost their lives. More recent catastrophic fires are mentioned in this report, among them the Yacolt fires in Washington in 1902, the great Idaho-Montana fires of 1910, and the Tillamook burn in Oregon in 1933. Today with tremendously improved fire control, we still suffer our greatest losses from the excep-

TABLE 114.—*Growth impact resulting from 1952 damage on commercial forest land in the United States and Coastal Alaska, by cause and section*

GROWING STOCK

Cause	Section of United States			Total, United States	Coastal Alaska	Total, United States and Coastal Alaska
	North	South	West			
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Fire	193	1, 378	115	1, 686	2	1, 688
Disease	2, 199	1, 847	850	4, 896	152	5, 048
Insects	398	363	976	1, 737	41	1, 778
Weather	245	149	540	934	23	957
Animals	869	39	101	1, 009		1, 009
Miscellaneous	401	223	105	729		729
Gross impact	4, 305	3, 999	2, 687	10, 991	218	11, 209
Salvage [1]	150	238	381	769		769
Net impact	4, 155	3, 761	2, 306	10, 222	218	10, 440

SAWTIMBER

Cause	North	South	West	Total, United States	Coastal Alaska	Total, United States and Coastal Alaska
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Fire	886	5, 802	680	7, 368	4	7, 372
Disease	7, 983	6, 953	4, 323	19, 259	630	19, 889
Insects	1, 414	1, 461	5, 569	8, 444	173	8, 617
Weather	597	575	2, 609	3, 781	88	3, 869
Animals	2, 451	87	184	2, 722		2, 722
Miscellaneous	505	558	295	1, 358		1, 358
Gross impact	13, 836	15, 436	13, 660	42, 932	895	43, 827
Salvage [1]	280	615	2, 194	3, 089		3, 089
Net impact	13, 556	14, 821	11, 466	39, 843	895	40, 738

[1] Utilized from dead trees in 1952.

tional fire or the unusually bad fire situation. The impact to the timber resource will continue to result largely from this characteristic pattern of fire damage.

This is not to say that fire is always detrimental to forest management. A carefully controlled burn can be useful in specific circumstances. Controlled fires, often called prescribed burns, create a favorable seedbeed for many species. A prescribed burn can sometimes be used to eliminate or check hardwoods or brush, reduce disease, or increase the browse or forage. Controlled fire is usually the most effective and practical means of eliminating logging debris on clear-cut areas so as to create conditions favorable for forest management and for the prevention of wildfire. However, except when used under rigid control, fire is absolutely incompatible with timber production—not to mention other forest values.

TIMBER LOSSES DUE TO FIRE

Total Impact on Growth Is Substantial

The mortality caused by fire and the growth losses constitute a substantial growth impact on the timber resource. For example, the impact resulting from 1952 fires amounted to 1,688 million cubic feet of growing stock, including 7,372 million board-feet of sawtimber. But because the severity of fire seasons fluctuates widely from year to year and place to place, the importance of growth impact can best be judged from annual averages. Table 117 shows that, for the country as a whole, losses resulting from the average year of the period 1948 to 1952 were somewhat higher than those resulting from 1952 fires.

Normally the South suffers about four-fifths of the losses, both to growing stock and sawtimber, and 1952 was no exception. In the North, how-

TABLE 115.—*Growth impact resulting from 1952 damage on commercial forest land in the United States and Coastal Alaska, by cause, and section and region*

Section and region	Impact on growing stock						Impact on sawtimber					
	Fire	Disease	Insects	Other	Total		Fire	Disease	Insects	Other	Total	
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Percent*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Percent*
North:												
New England	7	647	66	93	813	7	27	2, 067	175	186	2, 455	6
Middle Atlantic	46	550	67	253	916	8	297	2, 245	165	320	3, 027	7
Lake States	4	674	170	992	1, 840	16	9	1, 987	694	2, 552	5, 242	12
Central States	122	294	92	124	632	6	492	1, 550	359	397	2, 798	6
Plains	14	34	3	53	104	1	61	134	21	98	314	1
Total	193	2, 199	398	1, 515	4, 305	38	886	7, 983	1, 414	3, 553	13, 836	32
South:												
South Atlantic	105	346	118	43	612	5	497	1, 567	402	120	2, 586	6
Southeast	923	1, 142	139	210	2, 414	22	3, 804	4, 086	547	640	9, 077	21
West Gulf	350	359	106	158	973	9	1, 501	1, 300	512	460	3, 773	8
Total	1, 378	1, 847	363	411	3, 999	36	5, 802	6, 953	1, 461	1, 220	15, 436	35
West:												
Pacific Northwest	61	270	436	388	1, 155	10	375	1, 431	2, 518	1, 769	6, 093	14
California	32	191	244	99	566	5	197	1, 134	1, 452	259	3, 042	7
Northern Rocky Mountain	10	288	210	115	623	6	39	1, 296	1, 205	542	3, 082	7
Southern Rocky Mountain	12	101	86	144	343	3	69	462	394	518	1, 443	3
Total	115	850	976	746	2, 687	24	680	4, 323	5, 569	3, 088	13, 660	31
Total, United States	1, 686	4, 896	1, 737	2, 672	10, 991	98	7, 368	19, 259	8, 444	7, 861	42, 932	98
Coastal Alaska	2	152	41	23	218	2	4	630	173	88	895	2
Total	1, 688	5, 048	1, 778	2, 695	11, 209	100	7, 372	19, 889	8, 617	7, 949	43, 827	100

ever, the 1952 season was far more severe than usual and resulted in 193 million cubic feet of growth impact as compared to 92 million for the average year. The reverse was true in the West, where damages from 1952 fires were just half of those for the average year. Normally the cubic-foot growth impact for the North has been 5 percent of the national total, while that in the West has been 13 percent.

Although the total growth impact for the South is far greater than for other sections, the potential loss per acre in the West is much greater than in the South, because of the high per-acre timber volumes. The following tabulation shows that the growth impact per acre burned in 1952 was 7 to 10 times greater for the West than for the South, and larger for the South than for the North:

	Growth impact per acre burned in 1952	
	Cubic feet	*Board-feet*
North	54	247
South	145	610
West	1, 027	6, 071

Furthermore, many western fires are so intense that they kill entire stands of mature trees and devastate areas that will not again become forest without costly planting projects.

Total Growth Loss Exceeds Mortality

Nationally, 1952 growth loss was 6 to 8 times as large as mortality: 1,452 million cubic feet compared to 236 million, and 6,591 million board-feet compared to 781 million (table 117 and fig. 72). An even greater contrast exists between these two categories of growth impact for the North and South, especially the latter. In these sections, fires are generally of light or moderate intensity and their primary effect is on future growth and yield. In the South, the natural resistance of cordwood-size or larger pine trees results in a low mortality compared to other losses. In the West, where fires tend to burn more fiercely, mortality exceeds growth loss by 73 million cubic feet compared to 42 million cubic feet, and 414 million board-feet to 266 million.

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TABLE 116.—*Growth impact on commercial forest land resulting from damage in 1952, by section of the United States and Coastal Alaska*

GROWING STOCK

Section	Mortality	Growth loss	Growth impact	
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Percent*
North	1, 146	3, 159	4, 305	38
South	629	3, 370	3, 999	36
West	1, 635	1, 052	2, 687	24
Total, United States	3, 410	7, 581	10, 991	98
Coastal Alaska	100	118	218	2
Total, United States and Coastal Alaska	3, 510	7, 699	11, 209	100

SAWTIMBER

Section	Mortality	Growth loss	Growth impact	
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Percent*
North	2, 079	11, 757	13, 836	32
South	1, 768	13, 668	15, 436	35
West	8, 428	5, 232	13, 660	31
Total, United States	12, 275	30, 657	42, 932	98
Coastal Alaska	392	503	895	2
Total, United States and Coastal Alaska	12, 667	31, 160	43, 827	100

The Current Forest Fire Situation

An existing forest fire situation can best be characterized by the number of fires that occur, what causes them, where they start, and how many acres they burn. Such a basis has been used to describe the fire problem that exists today.

Man-Caused Fires Still a Problem

In 1952, as in many years previously, the activities of man caused the vast majority of forest fires. Even in the West, where lightning storms repeatedly sweep over highly flammable forests, more than half of the fires were man caused. Of the 1952 national total of 128,000 fires, 94 percent were man caused and only 6 percent were due to lightning (table 118).

Industrial activities, mainly railroads and lumbering, accounted for 5 percent of the fires in 1952. Although no exact figures are available, fires from these sources have sometimes been extremely damaging. Railroad fires are concentrated in the valleys or near the bottom of slopes, where topography is conducive to rapid spread. Fires that start in logging operations usually burn in heavy concentrations of slash and thus are difficult to control even when small. Many loggers and most timber operators recognize the seriousness of lumbering fires and have made outstanding progress in recent years in preventing them. The railroads have also done much to reduce the number of fires.

The general public, the individual woods user, and the farmer are by far the most numerous starters of fire. In 1952 almost 100,000, or 78 percent of all fires, were started by campers, smokers, debris burners, and incendiarists. Most of the 13,710 fires in the miscellaneous category were also started by people. Continued effort to cut down the number of such fires obviously is needed if fire losses are to be reduced.

The South leads the Nation in numbers of fires with 86,091, or 67 percent of the total. Incendiarism, debris burning (mostly in connection with farming activities), and smoking accounted for 69,005 fires. Since 82 percent of the growth impact from fire occurs in the South, this region clearly holds the key to future timber losses from fire.

In the North, smokers and debris burners started 16,625 of the 28,474 fires (58 percent) in 1952. That year this section had 22 percent of the national fire total.

In the West, lightning is still the greatest single fire starter, but smokers account for 17 percent of the burns.

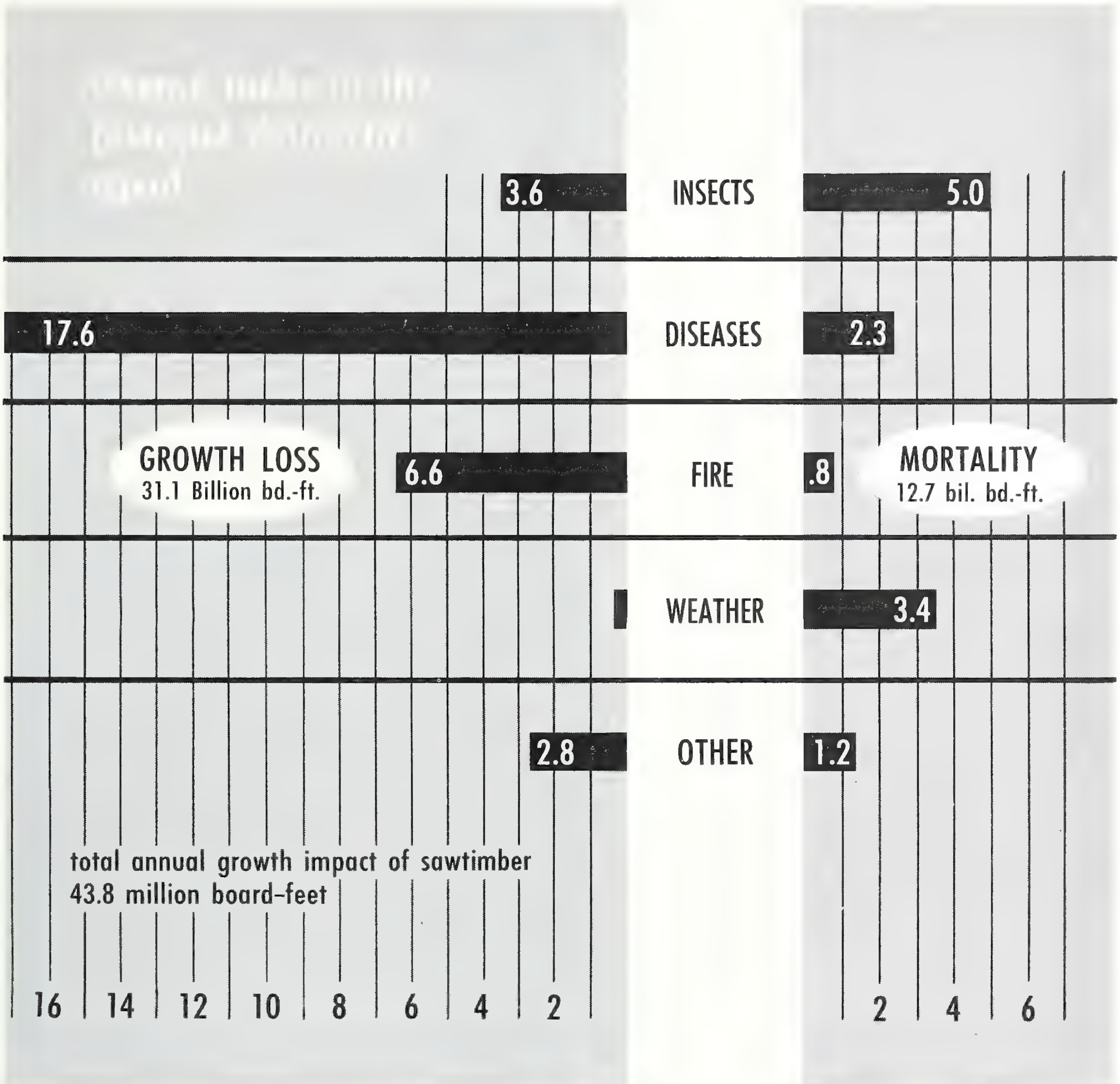
Area Burned in 1952 Near Current Average

The 1952 fire season was slightly more serious than average from the standpoint of acreage burned: 13,210,000 acres of commercial forest as compared to the 1948–52 average of 12,133,000 acres (table 119).

The situation is especially serious in the South, where 84 percent of the losses on commercial forest land occur. The 5 States of the Southeast Region contributed 7,925,000 acres to the annual average of 12,133,000 acres burned. Only 1,933,000 acres, or 16 percent of the average national loss, occurred in the entire North and West. In spite of the favorable average situation in these sections or in any particular region, the fact remains that in any one year an exceptionally heavy loss can occur. Thus, in 1952 the North burned twice its average and the Middle Atlantic Region almost three and one-half times its average.

Burned Area Mostly on Private Land

Almost 96 percent of the total 1952 burn occurred on lands in private ownership with the remainder about evenly split between Federal and other public lands (fig. 73). Of the 14,082,000 acres burned on private lands, 66 percent was in the South and 33 percent in the North, principally



includes Coastal Alaska

Figure 72

in the Central States (table 120). This burn was predominantly on commercial forest land. The area of private land burned in 1952 in the South was 5.2 percent of all privately owned forest land needing protection in that section. This is in contrast to the 3.3 percent for all private land nationwide and 2.2 percent of all land needing protection.

Although forest industry owners, countrywide, are doing an effective job in protecting their holdings from fire, such ownerships comprise only 13 percent of the total commercial area. An increasing number of other private forest owners all over the country are also aiding State foresters in providing statewide protection, and in many instances are supplementing State protection.

TABLE 117.—*Growth impact from fires of 1952 and from fires of the average year, 1948–52, on commercial forest land in the United States and Coastal Alaska*

Section	Growing stock						Sawtimber					
	1952				Average year 1948–52		1952				Average year 1948–52	
	Mortality	Growth loss	Growth impact		Growth impact	Proportion of United States total	Mortality	Growth loss	Growth impact		Growth impact	Proportion of United States total
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Percent*	*Million cu. ft.*	*Percent*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Percent*	*Million bd.-ft.*	*Percent*
North	36	157	193	11	92	5	71	815	886	12	421	5
South	126	1, 252	1, 378	82	1, 477	82	294	5, 508	5, 802	79	6, 220	78
West	73	42	115	7	235	13	414	266	680	9	1, 388	17
Total, United States	235	1, 451	1, 686	100	1, 804	100	779	6, 589	7, 368	100	8, 029	100
Coastal Alaska	1	1	2		(1)		2	2	4		(1)	
United States and Coastal Alaska	236	1, 452	1, 688				781	6, 591	7, 372			

[1] Data not available.

TABLE 118.—*Number of fires on protected land in continental United States, by cause and section, 1952*

Cause	North		South		West		Total, United States	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Lightning	384	1. 3	1, 446	1. 7	6, 182	46. 0	8, 012	6. 3
Railroads	1, 637	5. 7	1, 627	1. 9	347	2. 6	3, 611	2. 8
Lumbering	284	1. 0	2, 276	2. 6	514	3. 8	3, 074	2. 4
Total	1, 921	6. 7	3, 903	4. 5	861	6. 4	6, 685	5. 2
Camping	1, 476	5. 2	3, 176	3. 7	1, 015	7. 6	5, 667	4. 4
Smoking	8, 160	28. 7	15, 190	17. 6	2, 314	17. 2	25, 664	20. 0
Debris burning	8, 465	29. 7	16, 178	18. 8	1, 173	8. 7	25, 816	20. 2
Incendiarism	4, 457	15. 7	37, 637	43. 7	346	2. 6	42, 440	33. 2
Total	22, 558	79. 3	72, 181	83. 8	4, 848	36. 1	99, 587	77. 8
Miscellaneous	3, 611	12. 7	8, 561	10. 0	1, 538	11. 5	13, 710	10. 7
Total, all causes	28, 474	100. 0	86, 091	100. 0	13, 429	100. 0	127, 994	100. 0

But such owners tend to be the shining exceptions. Many more are not yet sufficiently concerned to obtain adequate protection.

A Look at the Status of Fire Control

Major Milestones in Fire Control

The initial step in the development of fire control on State and private forest lands was taken by the large industrial owners in the West. Wishing to protect their own holdings, they organized timber protective associations, the first of them in Idaho, in 1906. The States also began to recognize their responsibility in protecting private lands from fire and, by 1910, 16 had made a start toward organized fire control.

Two Federal legislative milestones gave impetus to the protection of State and private lands; the Weeks Law of 1911, and the Clarke-McNary Act of 1924. Under the highly effective cooperative fire-control program that resulted, the States provide the administration and accept direct responsibility for supervising and handling the job.

TABLE 119.—*Area burned in United States and Coastal Alaska, for 1952 and for the average year 1948–52*

Section and region	Commercial and noncommercial area burned, 1952 [1]		Commercial area burned		
			1952	Average year 1948–52	
	Thousand acres	*Percent*	*Thousand acres*	*Thousand acres*	*Percent*
North:					
New England	36	0. 2	36	26	0. 2
Middle Atlantic	748	5. 1	746	217	1. 8
Lake States	42	. 3	24	45	. 4
Central States	2, 792	19. 0	2, 778	1, 414	11. 6
Plains	1, 155	7. 8	(2)	2	(3)
Total	4, 773	32. 4	3, 584	1, 704	14. 0
South:					
South Atlantic	615	4. 2	605	432	3. 6
Southeast	7, 381	50. 2	7, 342	7, 925	65. 3
West Gulf	1, 676	11. 4	1, 567	1, 843	15. 2
Total	9, 672	65. 8	9, 514	10, 200	84. 1
West:					
Pacific Northwest	65	. 4	61	75	. 6
California	144	1. 0	24	84	. 7
Northern Rocky Mountain	33	. 2	14	19	. 2
Southern Rocky Mountain	23	. 2	13	51	. 4
Total	265	1. 8	112	229	1. 9
Total, United States	14, 710	100. 0	13, 210	12, 133	100. 0
Coastal Alaska	1	----------	1	----------	----------
Total, United States and Coastal Alaska	14, 711	----------	13, 211	----------	----------

[1] Includes the burn on 10 million acres of nonforest lands in California and North Dakota, intermingled with or adjacent to forest lands.

[2] Less than 500 acres.

[3] Negligible.

The Federal agency reimburses the States for specified expenditures and contributes leadership, technical help, and guidance when needed.

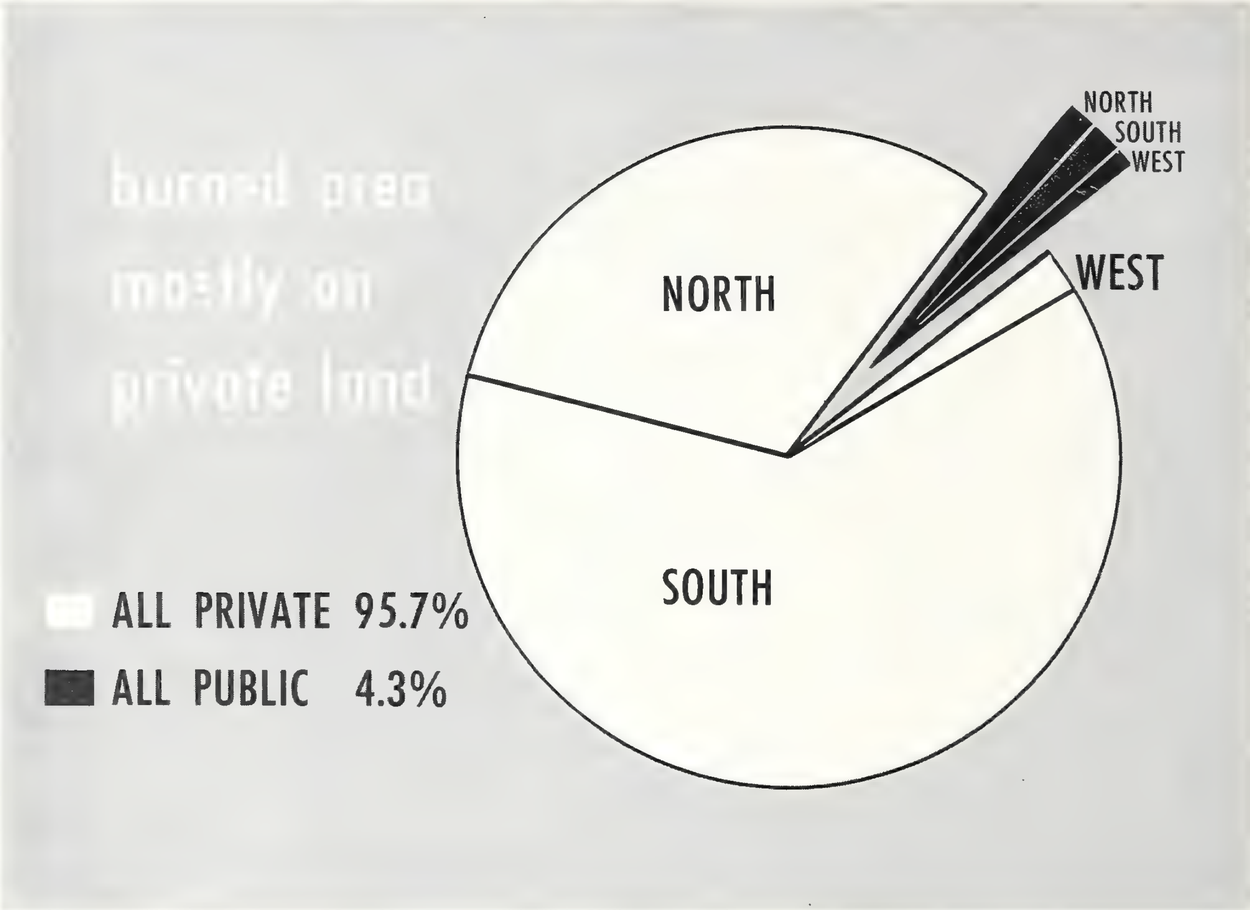
Over the years, fire control on Federal lands has been provided in most instances by the agency charged with managing the land. Organized protection of the national forests began soon after the establishment of the Forest Service in 1905. The protection of these forests has improved steadily in spite of greatly increased industrial and recreational use and the coincident increase in fire risk and hazard.

A large proportion of the Federal land, other than national forests, is administered by the Department of the Interior. Forty million acres were placed under protection in 1934 with the organization of the Grazing Service (which in 1946 became the Bureau of Land Management). Most of the 18 million acres of forest land in Indian ownership or trusteeship and the 6 million acres in national parks have been protected for many years.

Eighty-eight Percent of Lands Now Protected

Of the 673 million acres of land needing protection in the continental United States and Coastal Alaska,[41] 88 percent is under some form of organized protection (table 121). The 82 million unprotected acres are mostly in the North and South, where the greatest burned area occurs. Of the 12 forest regions in the United States, only 6 have any substantial amount of unprotected land. From table 121 it will be noted that 41 million unprotected acres lie in the Central and the Plains Regions. The 11 million acres in the Central Region are nearly all commercial land

[41] The area which fire specialists consider to require protection includes all commercial and noncommercial forest land except approximately 900 thousand acres of widely scattered commercial woodland in Ohio and Iowa. Included in the 673 million-acre total are 10 million acres of nonforest brush and grass lands, closely intermingled with or adjacent to forest areas.



west includes Coastal Alaska

Figure 73

and much of the 1952 fire impact occurred on these acres. Most of the 30 million unprotected acres in the Plains are noncommercial.

The most serious situation is in the South, where 31,554,000 acres, almost all commercial forest land, were unprotected in 1952. The 9 million acres of unprotected land in the Southern Rocky Mountain Region are almost all noncommercial.

Most Unprotected Land Is Privately Owned

Nearly 425 million acres of the land needing protection is in private ownership and 18.5 percent of this, or 78.6 million acres, is unprotected. The commercial portions of these unprotected lands are primarily in the South and in parts of the Central Region. As of 1952, the big share of such lands was in Florida, Mississippi, Tennessee, Louisiana, Arkansas, Kentucky, and Missouri; Oklahoma and Texas each have large areas of unprotected land, but most of it is noncommercial. The acreage of protected and unprotected land by ownerships is shown in table 122.

Intensity of Protection Varies Greatly

Since the fire protection problem is characterized by extreme fluctuations in time and place as the activities of fire-starting agencies fluctuate and fire weather varies, it is almost axiomatic that the success of a control program depends on the ability of an organization to meet critical situations and peak-load periods. A measure of the intensity or level of the fire protection effort is therefore a useful gage in the evaluation of the status of protection.

To get a general measure of the adequacy of current protection, the effectiveness of existing protection was rated in four broad classes. These classes express the ability of fire organizations, with their 1952 facilities, to meet successfully the critical situations of fire danger and numbers of

TABLE 120.—*Area of commercial and noncommercial forest land*[1] *burned in United States and Coastal Alaska, by ownership, 1952*

Ownership	Total area burned	Proportion of total burned area	Proportion of all forest land requiring protection
	Thousand acres	*Percent*	*Percent*
Private:			
North	4, 599	31. 3	2. 69
South	9, 287	63. 1	5. 19
West	196	1. 3	. 26
Total, all private	14, 082	95. 7	3. 32
Federal:			
National forest	149	1. 0	. 11
Bureau of Land Management	30	. 2	. 08
Indian	64	. 5	. 36
National parks	1	(2)	. 02
Other Federal	118	. 8	1. 05
Total, all Federal	362	2. 5	. 17
Other public	267	1. 8	. 80
Total, all public	629	4. 3	. 25
All ownerships	[1] 14, 711	100. 0	2. 18

[1] 1,501,000 acres of total burn was on noncommercial forest land and on nonforest lands in California and North Dakota, comprised as follows: 1,189,000 acres in North, 158,000 in South, and 154,000 in West

[2] Negligible.

fires that are typically encountered in each State and region. Definitions of the four classes follow:

Class 1.—Protection adequate to meet the fire situation in worst years and under serious peak loads.

Class 2.—Protection adequate to meet the average fire situation, but failures likely in the worst years and under peak loads.

Class 3.—Protection adequate to meet fire situations only in the easy years, and failures frequent in average or worse years.

Class 4.—Unprotected.

About 100 million acres, or 15 percent of the total forest land requiring protection, received Class 1 protection in 1952 (table 123). When viewed realistically, this area on which adequate protection can be achieved during the worst years is relatively small. In contrast, 357 million acres, or 53 percent, received Class 2 protection. Control failures and heavy losses can be expected on Class 2 land when organizations are swamped with an overload of fire work due to large numbers of fires burning under highly dangerous conditions. An additional 135 million acres, or 20 percent, received Class 3 protection; here frequent failures and heavy losses can be expected even in average years. During bad years, the effort needed to meet emergencies on this poorly protected area is an added overload on the 357 million acres of Class 2 land, making 73 percent of our protected forest area subject to heavy losses in extremely bad fire years.

A big protection job is yet to be done on the private lands. The percentage of such land under Class 1 and 2 protection is less than that for Federal and other public ownerships: 59 percent as opposed to 83 percent and 76 percent, respectively. Public and private owners, however, have about the same acreage of land under Class 1 protection. Table 123 and figure 74 show the comparative acreages in Class 1 and the other categories by ownerships.

The North, with 29 percent of its land in Class 1, leads the country in high-level protection, mainly because of the excellent achievement on private lands in the Middle Atlantic and Lake States Regions, and on public lands in those regions and New England (table 124). The greatest opportunity for improvement in the North is in the Central States and Plains Regions. Only 6 percent in the Central States and a negligible amount in the Plains is under Class 1 protection.

In the South, great opportunities exist to intensify protection and thereby reduce losses on commercial land. In this region only 1 percent of the land received Class 1 protection in 1952. Sixty percent had Class 2, 23 percent had Class 3, and 16 percent was unprotected. The South Atlantic Region had the best record.

The level of protection in the West was close to the national average, with 15 percent of all land getting Class 1 protection. The Northern and Southern Rocky Mountain Regions had the best protection in the West, although 10 percent of the Southern Rockies still is unprotected. California had 12 percent in Class 1 and 42 percent in Class 2. Much of the remaining 46 percent, all in Class 3, is extremely flammable brushland, highly important for watershed purposes, but with virtually no timber values.

In the Pacific Northwest, only 1 percent of the forest area received Class 1 protection, but 96 percent had Class 2 coverage. This gives the region one of the best overall classifications, although the problem of meeting extreme emergencies still exists on most of the area.

Effective Fire Control Expenditures Unchanged in Recent Years

The $63 million expenditure for the control of forest fires in 1952 indicates the determination of Federal, State, and private landowners and magers to get on top of the fire problem. However, the steady increase in money spent for fire control by all agencies has been considerably offset by

TABLE 121.—*Commercial and noncommercial forest land*[1] *requiring protection from fire, and area protected during 1952, by section and region of United States and Coastal Alaska*

Section and region	Total area requiring protection	Protected area	Unprotected forest land: Area	Unprotected forest land: Proportion of total forest area requiring protection
	Thousand acres	*Thousand acres*	*Thousand acres*	*Percent*
North:				
New England	31, 378	31, 378		
Middle Atlantic	44, 894	44, 894		
Lake States	55, 201	55, 199	2	(2)
Central	41, 827	30, 554	11, 273	27
Plains	35, 168	4, 933	30, 235	86
Total	208, 468	166, 958	41, 510	20
South:				
South Atlantic	47, 288	45, 399	1, 889	4
Southeast	96, 906	79, 657	17, 249	18
West Gulf	53, 071	40, 655	12, 416	23
Total	197, 265	165, 711	31, 554	16
West:				
Pacific Northwest	54, 131	54, 131		
California	52, 082	52, 082		
Northern Rocky Mountain	55, 261	55, 184	77	(2)
Southern Rocky Mountain	89, 630	80, 381	9, 249	10
Total	251, 104	241, 778	9, 326	4
United States	656, 837	574, 447	82, 390	13
Coastal Alaska	16, 508	16, 508		
Total	673, 345	590, 955	82, 390	12

[1] Includes approximately 185 million acres of noncommercial forest land; of this total, 10 million acres is nonforest land in California and North Dakota. The total comprises 35 million acres in the North, 4 million acres in the South, 134 million acres in the West, and 12 million acres in Coastal Alaska.

[2] Negligible.

the decreasing value of the dollar. The following tabulation shows little significant change in effective fire control funds from 1932 to the mid-1940's. Following the war, an increase of about a third in terms of 1952 dollars was realized.

Year:	*Actual expenditure*	*Buying power of the dollar*[1] *1952=1.00*	*Expenditures in 1952 dollars*
1932	$12, 100, 000	3. 3	$40, 066, 000
1937	15, 400, 000	2. 4	37, 470, 000
1942	21, 300, 000	2. 0	43, 293, 000
1947	44, 600, 000	1. 4	62, 378, 000
1952	63, 200, 000	1. 0	63, 200, 000

[1] Derived from U. S. Dept. of Commerce *Business Statistics*, 1955 edition, indexes for labor, supplies, and equipment.

It is significant to note that there was no important change in effective dollar expenditures from 1947 to 1952, a period when protected area increased substantially and the demands for better resource protection likewise advanced. It is to the credit of fire protection forces everywhere that fire losses did not creep up as available funds became spread thinner and thinner. Obviously, this trend cannot long continue before the weight of a bigger job under more or less fixed financial resources will result in greater timber losses.

Today almost half of the total fire-control bill is in the West (table 125), where under hazardous combinations of fuel, weather, and topography, fire organizations have achieved considerable success but not completely satisfactory protection. About one-third of the total expenditure is in the South, with a substantial part of the cost in the Southeast Region. New England, the Middle Atlantic, and the Lake States Regions spend most of the fire-control dollars in the North.

Expenditures made in 1952 to protect private forest land totaled $43 million, or 67 percent of the national total. Slightly over $15 million, or 24 percent, was spent on the national forests. Expenditures on forest land of different ownerships in 1952 are shown in table 126.

TABLE 122.—*Ownership of commercial and noncommercial forest land* [1] *requiring protection from fire, and area protected during 1952, United States and Coastal Alaska*

Ownership	Total area requiring protection	Protected	Unprotected: Area	Unprotected: Proportion of ownership area requiring protection
	Thousand acres	*Thousand acres*	*Thousand acres*	*Percent*
Private	424, 694	346, 080	78, 614	18. 5
National forest	140, 268	140, 268	0	0
Bureau of Land Management	39, 661	39, 528	133	. 3
Indian	18, 013	17, 476	537	3. 0
National park	5, 933	5, 933	0	0
Other Federal	11, 253	10, 473	780	6. 9
Other public	33, 523	31, 197	2, 326	6. 9
Total	673, 345	590, 955	82, 390	12. 2

[1] Includes approximately 175 million acres of noncommercial forest land and 10 million acres of nonforest land in California and North Dakota.

TABLE 123.—*Class of protection on all lands protected from forest fire during 1952, United States and Coastal Alaska*

Ownership	Protected land: Class 1	Class 2	Class 3	Total
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*
Private	52, 043	199, 926	94, 111	346, 080
Federal:				
National forest	22, 501	102, 734	15, 033	140, 268
Bureau of Land Management	9, 087	25, 306	5, 135	39, 528
Indian	635	7, 276	9, 565	17, 476
National parks	3, 399	2, 508	26	5, 933
Other Federal	364	4, 893	5, 216	10, 473
Total	35, 986	142, 717	34, 975	213, 678
Other public	11, 593	14, 008	5, 596	31, 197
All ownerships	99, 622	356, 651	134, 682	590, 955

It is not only of interest to examine where fire control funds are spent but also to analyze who foots the bill. In 1952, Federal sources paid 43 percent of the total cost, State organizations 40 percent, and private groups 17 percent. Actual amounts were as follows:

Source of funds:	*Expenditures*	*Percent of total*
Federal	$27, 211, 000	43
State	25, 505, 000	40
Private	10, 497, 000	17
Total	$63, 213, 000	100

The States are shouldering a substantial part of the burden of protecting State and private lands. However, in addition to the expenditures listed above, many private agencies are raising the level of protection for selected high-value areas. They are financing hazard reduction along railroads, logging areas, and other dangerous places. The outstanding progress that has been made in expanding fire control over the years is due in large measure to the efforts of State, private, and Federal agencies in attacking the job cooperatively. The protection job remaining to be done can best be accomplished by a continuation of this joint effort.

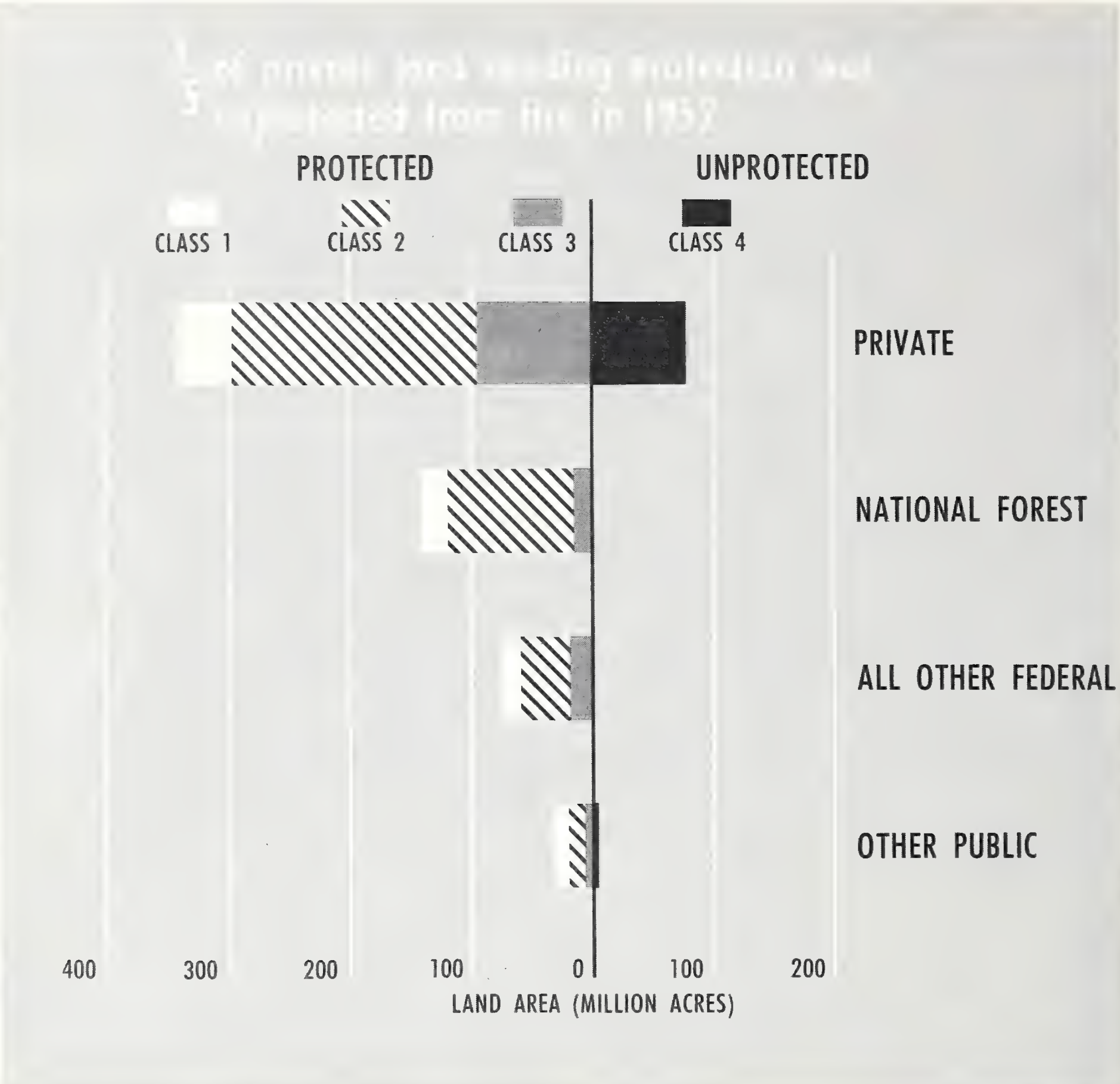
Current Trends Toward Better Fire Control

The growth of fire control in the United States emphasizes the increasing support given by all agencies to this important activity. Nowhere in the world has such an extensive and highly skilled fire organization been developed. But there are still many places where improved protection is desirable and essential. Current trends indicate the extent to which better fire control may be achieved in the near future.

Man-Caused Fires Can Be Reduced

Cooperation, especially in forest fire prevention, has developed amazingly in recent years. The Cooperative Forest Fire Prevention program, under the sponsorship of the National Advertising Council, illustrates how effective the combined efforts of Federal, State, industrial, and other private organizations can be. The "Keep Green" programs in 36 States are outstanding examples of industrial and State cooperation. A multitude of other organizations and groups are working toward the common goal of reducing the number of man-caused forest fires.

The 7-percent reduction in number of fires in the decade ending in 1952, as compared to the previous decade, indicates major progress, but the gains are far greater than this percentage would indicate. During this time, the recreational use of the forests increased manyfold. Timber harvesting and other industrial uses both increased, so that large areas of high-hazard logging slash and more high-risk industrial areas were created.



includes Coastal Alaska

Figure 74

While a sustained nationwide effort is needed to hold the gains made, a great opportunity exists, especially in the South, to reduce the large number of man-caused fires, particularly those started by incendiarists. In the West, better methods of hazard abatement and fuller application of existing methods, or both, are needed to prevent fires on cutover lands where high fire hazard follows cutting. Indications are that adequate fire laws and regulations will be enacted or

Table 124.—*Class of protection from fire on commercial and noncommercial forest land during 1952, by section and region, and by ownership, United States and Coastal Alaska*

Section and region	Federal forest land in protection class—				Other public forest land in protection class—				Private forest land in protection class—				All ownerships of forest land in protection class—			
	1	2	3	Unprotected	1	2	3	Unprotected	1	2	3	Unprotected	1	2	3	Unprotected
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
North:																
New England	93	7			61	39			25	75	(1)		28	72	(1)	
Middle Atlantic	81	19			88	12	(1)		62	21	17		66	20	14	
Lake States	30	55	15	(1)	33	42	25		36	48	16		34	48	18	(1)
Central States	2	80	18	(1)	6	49	45		6	21	44	29	6	25	42	27
Plains [2]	3	3	40	54	7		21	72		1	11	88	(1)	1	13	86
Weighted average	31	44	17	8	49	33	17	1	26	32	19	23	29	33	18	20
South:																
South Atlantic	11	82	7	(1)		74	26			78	18	4	1	78	17	4
Southeast	1	88	10	1	(1)	42	48	10	1	49	31	19	1	51	30	18
West Gulf	1	88	9	2		56	44		3	56	16	25	2	59	16	23
Weighted average	4	86	9	1	(1)	52	42	6	1	58	24	17	1	60	23	16
West:																
Pacific Northwest	1	98	1			94	6		2	92	6		1	96	3	
California [3]	13	34	53		41	59			11	49	40		12	42	46	
Northern Rocky Mountain	19	69	12		21	67	9	3	19	52	28	1	19	67	14	(1)
Southern Rocky Mountain	28	58	14		3	25	8	64	5	21	30	44	23	50	17	10
Weighted average	18	65	17		7	63	7	23	8	56	26	10	15	62	19	4
United States	18	65	16	1	34	42	17	7	12	47	22	19	15	52	20	13
Coastal Alaska	5	81	14						8	84	8		5	81	14	
United States and Coastal Alaska	17	66	16	1	34	42	17	7	12	47	22	19	15	53	20	12

[1] Negligible.

[2] Approximately 500,000 acres of nonforest land included.

[3] Approximately 9,540,000 acres of nonforest land included.

adopted in all States in the near future. Progress may be expected in law enforcement. Thus, the trend is toward continued progress in all phases of prevention.

Protected Area Being Increased Rapidly

Although only 12 percent of the country's 673 million acres of forest lands that need protection are still without some coverage, 53 percent of the 1952 burned area occurred on these lands. In the average year almost three-fourths of the losses occur on the unprotected area. Thus, the extension of organized protection to this remaining 82 million acres is important, if future burned area is to be reduced significantly.

The outlook for extending protection is bright. Since 1945 the protected area has risen about 9 million acres per year. If the favorable trend continues, even at a slightly reduced rate, by 1960 the protected area will probably reach 630 million acres, and by 1970 there should be virtually no important lands unprotected.

Intensification of Fire Control Is Big Challenge

It was brought out earlier that only 15 percent of all forest lands requiring protection have Class 1 protection and 53 percent have Class 2. Thus, 32 percent fall in the highly inadequate Class 3 category or are unprotected (Class 4). Figure 75 shows that area burned per million acres protected declines sharply as the percentage of land under Class 1 and 2 protection increases. This relation was determined from the records of 37 States which in 1952 experienced burning conditions severe enough to test the organizations responsible for protection.

From the characteristically heavy losses that occur during emergency fire periods, it is obvious that the level of protection defined in both Class

TABLE 125.—*Expenditures for forest fire control on commercial and noncommercial forest land [1] during 1952, by section and region of the United States and Coastal Alaska*

Section and region	Expenditures	
	Dollars	*Percent*
North:		
New England	2, 343, 300	3. 7
Middle Atlantic	2, 658, 000	4. 2
Lake States	4, 758, 400	7. 5
Central	2, 230, 800	3. 5
Plains	111, 600	. 2
Total	12, 102, 100	19. 1
South:		
South Atlantic	4, 207, 200	6. 7
Southeast	12, 325, 700	19. 5
West Gulf	3, 702, 700	5. 8
Total	20, 235, 600	32. 0
West:		
Pacific Northwest	8, 024, 800	12. 7
California	[1] 15, 608, 800	24. 7
Northern Rocky Mountain	4, 159, 500	6. 6
Southern Rocky Mountain	3, 059, 900	4. 8
Total	30, 853, 000	48. 8
United States	63, 190, 700	99. 9
Coastal Alaska	22, 100	. 1
Total	63, 212, 800	100. 0

[1] Includes expenditures for protecting 9½ million acres of nonforest land in California.

TABLE 126.—*Expenditure for forest fire control during 1952 on lands of different ownerships in the United States and Coastal Alaska*

Ownership	Expenditures	
	Dollars	*Percent*
Private:		
North	9, 713, 300	15. 4
South	17, 730, 600	28. 0
West	15, 224, 000	24. 1
All private	42, 667, 900	67. 5
National forest	15, 370, 000	24. 3
Other Federal	2, 456, 300	3. 9
Other public	2, 718, 600	4. 3
All public	20, 544, 900	32. 5
United States and Coastal Alaska	63, 212, 800	100. 0

2 and Class 3 is inadequate to prevent substantial fire losses during severe fire weather. If burned acreages are to be reduced, it will be essential that the level of protection be stepped up, not only by moving unprotected (Class 4) land into the Class 3 category but by intensifying organized effort all along the line. The southern regions and parts of the Central Region are faced with the biggest challenge. In the West, the difficult tasks are to intensify control in some problem areas and to keep prepared against the continuous threat of serious losses.

Area Burned Is Trending Downward

The combination of (1) better fire prevention, (2) extended coverage of organized protection, and (3) gradually increased effectiveness of fire control has produced a steady reduction in area burned over the years. The downward trend in area burned since 1935 reflects the results of the Civilian Conservation Corps program of the 1930's, strengthened State fire control organizations, better leadership by all agencies, and greatly expanded fire control facilities and finances.

The area burned on all lands requiring protection (fig. 76) has dropped steadily since the 1930's. In the past 10 years, however, the decrease has been due entirely to reduced losses on lands being placed under protection for the first time. Present trends in total area burned indicate a gradual leveling off in the next 10 to 15 years.

The historic development of better fire control on Federal lands and the pattern of protection on State and privately owned lands under the Clarke-McNary Act of 1924 promise future reductions in area burned. In consideration of this and present trends in area burned, it is estimated that by 1960 the area burned on all 673 million acres needing protection in the United States and Coastal Alaska will have been reduced almost 6 million acres, or 40 percent compared to 1952. The distribution of the anticipated acreage burned in 1960 by sections as compared to 1952 is:

	Area burned in 1952		*Estimated burn, 1960*	
Section:	*Total (M acres)*	*Proportion of total forest area requiring protection (percent)*	*Total (M acres)*	*Proportion of total forest area requiring protection (percent)*
North	4, 773	2. 3	1, 213	0. 6
South	9, 672	4. 9	7, 181	3. 6
West and Coastal Alaska	266	. 1	357	. 1
Total United States and Coastal Alaska	14, 711	2. 2	8, 751	1. 3

Although total burn, hence growth impact from fire, is being reduced steadily, the trend of area burned on protected land is unsatisfactory. For the country as a whole, there has been no significant improvement since about 1940. In fact, burned area per million acres protected (fig. 77) seemed to be on the increase from 1949 to 1952 for the country as a whole. The situation in the South is worse than in other sections. There the great gains made as a result of extending protection to unprotected areas have been partly offset by increased losses on protected areas.

Figure 75.—Area burned per million acres protected, 37 States, in relation to protection status, 1952.

The upswing in area burned per million acres protected in the South and the lack of much improvement in the North and West is disturbing. Although actual funds available have increased 40 percent since 1947, the coincident increase in area over which available funds are spread, together with a decrease in the value of the dollar, has weakened the per-acre effectiveness of fire control.

An anticipated expansion in fire control forces and facilities will result from forest fire protection compacts that have been organized among the States. These compacts, federally approved, are intended to encourage member States to develop integrated forest fire plans, maintain adequate forest fire-fighting services, and provide mutual aid in fighting fires.

STATUS OF PROTECTION FROM DISEASES

Tree diseases operate in many ways that reduce the final yield of timber stands and the quality of the wood produced. Root diseases kill or stunt large numbers of trees. Bark diseases may girdle and kill trees or produce open wounds leading to decay. Wood-rotting diseases reduce or destroy the merchantability of timber. Leaf and needle diseases check growth and sometimes kill.

Most of our forest tree diseases are native, that is, so far as we know, they have always existed in this country. This group includes most of our heart rots and many other normally endemic diseases. Native diseases, however, sometimes become temporarily epidemic. Many of our most destructive diseases, for example, white pine blister rust and chestnut blight, are not native but are known to have been introduced into this country from other continents. Parasites brought into a new region often find some tree species particularly susceptible to their attack, partly because of the lack of any established balance between parasite and the new host. This results in an epidemic.

One of the features of disease problems is that

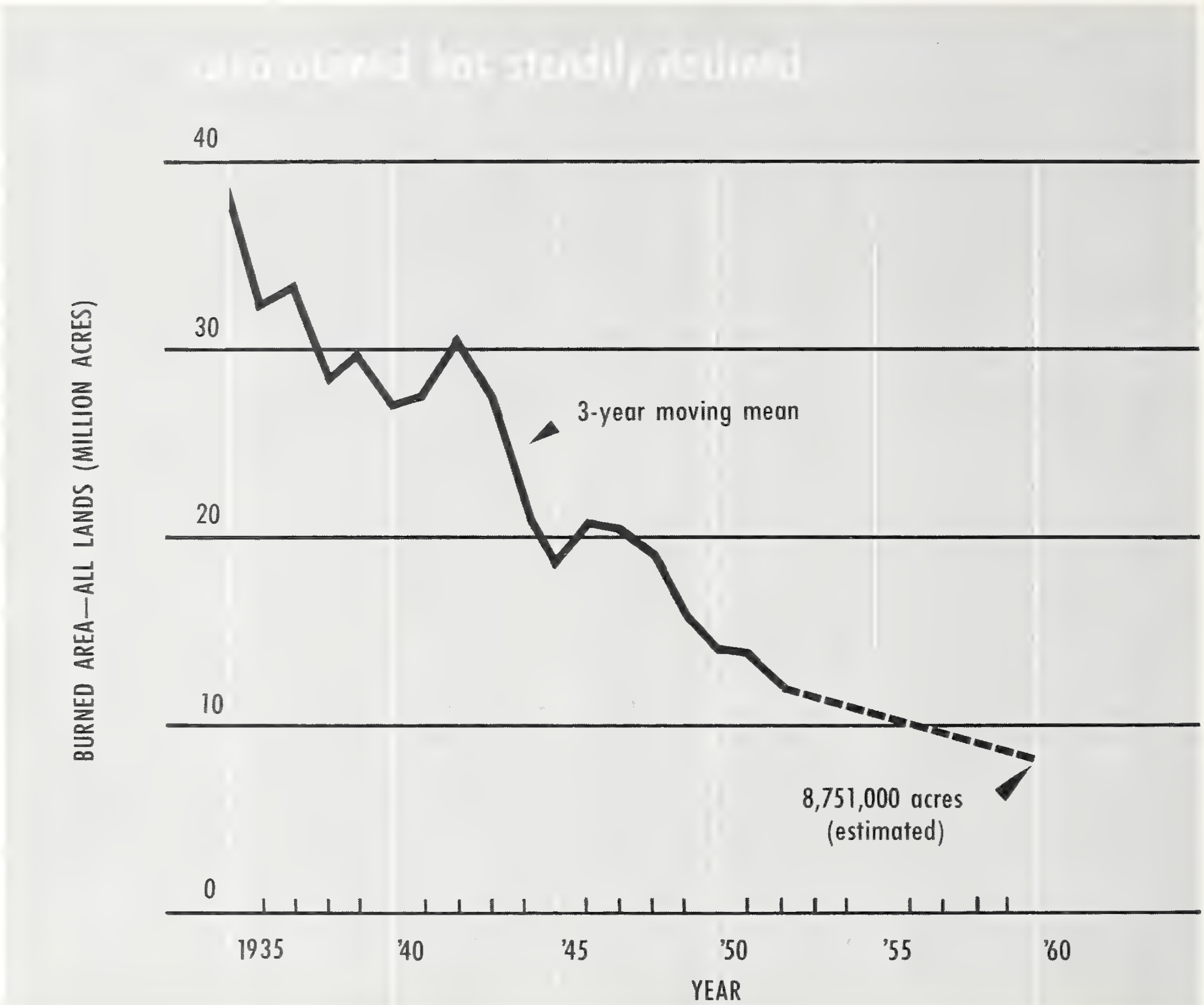


Figure 76

new diseases continue to appear. Since the turn of the century, a large number of serious or potentially serious diseases have attracted attention in this country. Some were inadvertently introduced from foreign lands. The source of others is not known. Still others have very likely resulted from epidemic behavior of normally endemic diseases. A tabulation of some of the more outstanding diseases regarded as new to this country since about 1900 is shown below.

Disease	*Species attacked*	*Cause*	*Year first reported* [1]
Chestnut blight	Chestnut	Fungus	1904
Blister rust	5-needle pines	do	1906
Phloem necrosis	Elms	Virus	1918
Beech bark disease	Beech	Fungus and insect	1920
Larch canker	Larches	Fungus	1927
Pole blight	Western white pine	Unknown	1929
Birch dieback	Birches	do	1930
Dutch elm disease	Elms	Fungus	1930
Littleleaf	Shortleaf and loblolly pine	do	1932
Persimmon wilt	Persimmon	do	1933
Oak wilt	Oaks and chestnuts	do	1942
Sweetgum blight	Sweetgum	Unknown	[2] 1951

[1] In some cases, notably oak wilt, littleleaf, and phloem necrosis, the diseases were almost certainly present many years before they were identified.

[2] A similar or possibly identical disease of sweetgum was first reported in 1944.

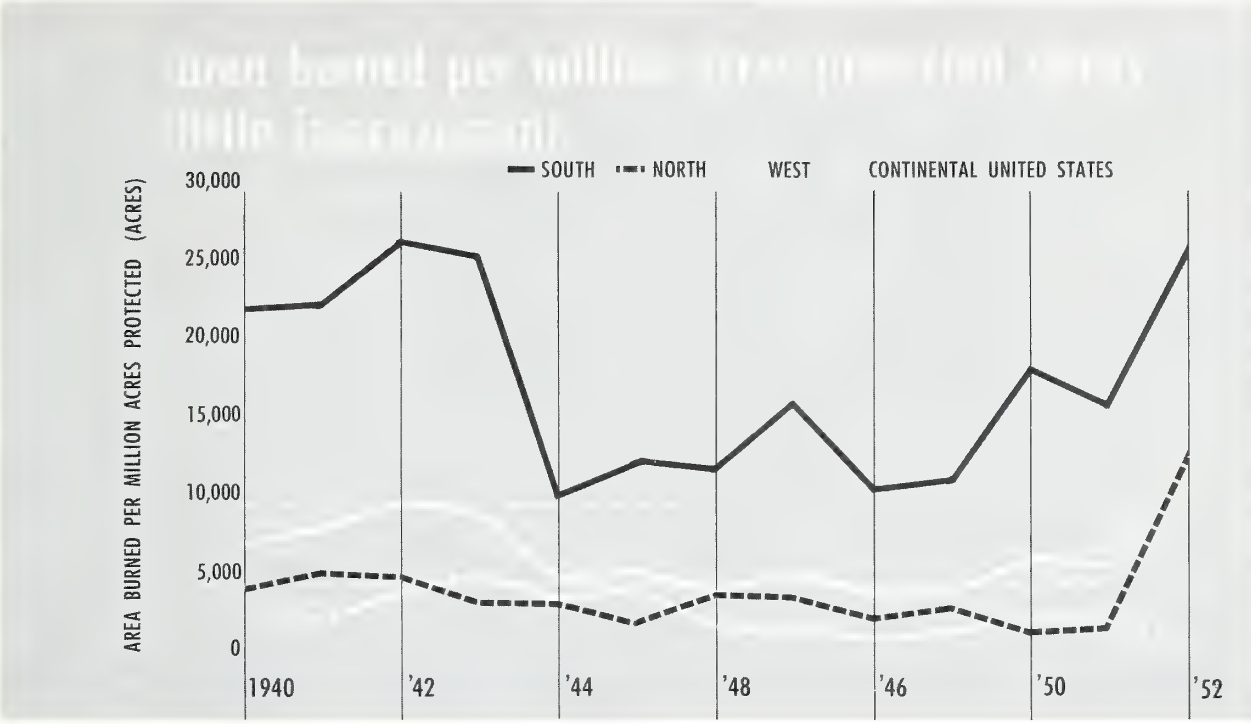


Figure 77

Some diseases, such as chestnut blight, have caused catastrophic losses. Some, such as blister rust, are being held in check in most areas through rigorous control efforts; others, such as littleleaf, are being combated through adjusted management practices, and still others are at present mainly in the status of threats, such as oak wilt and sweetgum blight, or of no great importance to our timber resource, such as persimmon wilt. During the past half century, the incidence of "new" diseases presents no clear trend. For the 5 decades included, the number of serious new forest diseases reported varied from 2 to 4 per decade, with a peak in the 1930's.

In addition to the diseases reported above as new since 1900, there have been buildups of major consequence, often associated with abnormal weather or changes in forest conditions, on the part of several diseases native with us, or naturalized many years ago. Diseases of this type that have risen in importance at one time or another since 1900 include Elytroderma needle cast on ponderosa pine and fusiform rust of southern pines.

In the tables in this report dealing with growth impact from destructive agents, the losses from all types of events are included, whether endemic or epidemic, introduced or native. The only exceptions are the losses from those individual catastrophic events that are listed in table 133, p. 217.

Diseases Reduce Our Timber Supply

Earlier, it was shown that diseases cause 22 percent of the growing-stock mortality and 56 percent of the growth loss, representing 45 percent of the impact on total national growth. While this tremendous volume loss is composed of major damage by many diseases, 3.4 of the 5.0 billion cubic feet is ascribable to the heart rots alone. The bulk of the growth impact from diseases is growth loss rather than mortality (table 127 and fig. 72). Such diseases as the heart rots, leaf diseases, and killers of seedlings and saplings cause little mortality loss of measurable volume, yet account for the larger share of the ultimate effect of disease on wood production.

The damage is not localized in any particular section of the country (table 128). Thus, 40 percent of the Nation's 1952 growth impact from disease on sawtimber is in the North, largely the Northeast and Lake States, 35 percent is in the South, 22 percent in the West, and 3 percent in Coastal Alaska.

TABLE 127.—*Mortality from disease compared with growth loss, by section, of the United States and Coastal Alaska, 1952*

GROWING STOCK

Section	Mortality	Growth loss	Growth impact
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*
North	461	1, 738	2, 199
South	73	1, 774	1, 847
West	190	660	850
Coastal Alaska	49	103	152
Total, United States and Coastal Alaska	773	4, 275	5, 048

SAWTIMBER

Section	Mortality	Growth loss	Growth impact
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*
North	914	7, 069	7, 983
South	233	6, 720	6, 953
West	891	3, 432	4, 323
Coastal Alaska	204	426	630
Total, United States and Coastal Alaska	2, 242	17, 647	19, 889

MANY KINDS OF DISEASE CAUSE MAJOR LOSSES

Some of the more important diseases, on the basis of sawtimber loss, are discussed in the following paragraphs. These diseases are arranged in a decreasing order of importance according to growth impact that resulted from damage they caused in 1952.

Heart rot can take place in any tree exposed to infection as a result of injuries, old age, or natural pruning. It occurs in all tree species and in all regions. The cull that the rots cause limits the optimum rotation age for many species, becoming critical, for example, in aspen in the Lake States at about 50 years, balsam fir at 70 years, scarlet oak at 100 years, white fir at 150 years, and Site II Douglas-fir not until 300 years. In eastern hardwoods, 45 percent of the monetary damage following the average fire results from heart rot that develops from the basal scars. It was common practice in the past, but to a lesser extent today, to leave badly decayed trees standing following logging, thus increasing the proportions of rotten cull trees occupying the sites. Our past high heart rot losses have been in part related to this practice of "high-grading."

TABLE 128.—*Growth impact of damage by disease on commercial forest land in the United States and Coastal Alaska, 1952*

Disease	Impact on growing stock					Impact on sawtimber					
	North	South	West	Coastal Alaska	Total, United States and Coastal Alaska	North	South	West	Coastal Alaska	Total, United States and Coastal Alaska	Proportion of total impact
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million bd.-ft.*	*Million bd.-ft*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Percent*
Root:											
Douglas-fir root rot			96		96			454		454	2. 3
Littleleaf		43			43		146			146	. 8
Stem:											
Heart rots	1, 511	1, 487	309	62	3, 369	6, 405	5, 840	1, 928	332	14, 505	72. 9
Blister rust	103		46		149	349		274		623	3. 2
Dwarfmistletoe	9		171		180	3		577		580	2. 9
Fusiform rust		97			97		281			281	1. 4
Hardwood cankers	152				152	186				186	. 9
Foliage:											
Brown spot		16			16		59			59	. 3
Elytroderma needle cast			9		9			46		46	. 2
Systemic:											
Birch dieback	216				216	494				494	2. 5
Pole blight			14		14			61		61	. 3
Oak wilt	13				13	47				47	. 2
Sweetgum blight	1	47			48	1	41			42	. 2
Miscellaneous	194	157	205	90	646	498	586	983	298	2, 365	11. 9
Total, all diseases	2, 199	1, 847	850	152	5, 048	7, 983	6, 953	4, 323	630	19, 889	100. 0

Blister rust losses are being held to a low level in most of the East by the control program. On private lands in the Lake States, the rust is materially damaging young stands, which represent the predominant age class of the region. In the Northern Rocky Mountain Region, the rust has become established throughout the range of white pine. In the Inland Empire, losses are already heavy, but the rust's full effect has not yet been felt. In California the rust has spread south to the central Sierra Nevada and is causing considerable damage in the northern end of the State. The effectiveness of control programs in the West has been demonstrated, however.

The *dwarfmistletoes* lead the diseases in amount of damage caused in the Southern Rocky Mountain Region, and also cause considerable damage to ponderosa pine, lodgepole pine, and Douglas-fir elsewhere in the West, and to black spruce in the Lake States. Trees of all sizes are attacked. Some are killed before they reach merchantable size, and others are stunted for long periods.

Birch dieback, since 1930, has destroyed much of the yellow and paper birch in New England and adjacent Canada. It is New England's most devastating disease since the chestnut blight. Damage from this disease in 1952 resulted in a growth impact of 494 million board-feet. Its exact nature and cause are not completely understood, but there can be little doubt that reduced rainfall and abnormally high temperatures are implicated. The bronze birch borer has added to the destruction by killing many trees weakened by dieback.

Root rot caused by *Poria weirii* damages many western conifers, but is particularly serious on Douglas-fir in the Pacific Northwest, where it severely attacks stands as young as 20 to 60 years of age. There is no question but that this disease, with a current annual growth impact of 454 million board-feet, has become a major silvicultural problem in the Northwest.

Fusiform rust is the most important disease of loblolly and slash pines. The alternate hosts for this southern rust are the oaks. Although trees of all ages are susceptible, the stem cankers that kill seedlings and saplings are the most damaging. The disease continues to increase as fire protection favors the increase in oak over pine and also increases the proportion of loblolly and slash pines at the expense of the more rust-resistant longleaf.

The *hardwood canker diseases* attack a wide range of species, expose the trunks to decay, and lead to cull, wind breakage, and reduced wood quality. They are important primarily in New England, and the Middle Atlantic, Central, and Lake States. Hypoxylon canker of aspen causes by far the most serious disease mortality loss in the Lake States.

Littleleaf, a fungus root disease associated with poor internal soil drainage and soil deterioration, attacks shortleaf and to a lesser extent loblolly pine. It is the most important silvicultural problem in shortleaf management in much of the Piedmont and in the upper Coastal Plain of Alabama. It reaches important proportions on 6 million acres from Virginia to Mississippi, and occurs in scattered stands over a wider acreage, with a total current annual growth impact of 146 million board-feet.

Pole blight is a disease of undetermined cause, characterized by dieback and gradual decline of the entire crowns, leading to the complete breakup of large areas of pole-sized western white pine. This blight caused a growth impact of 61 million board-feet, almost all in trees 8 to 20 inches in diameter. Blighted stands now occupy 92,000 acres in northern Idaho and adjacent Washington and Montana.

Brown spot is a fungus disease of the needles and one of the main reasons that longleaf pine remains in the "grass" stage for many years before starting height growth. Where brown spot has been controlled by either prescribed burning or by foliage sprays, early height growth has been initiated and the time required to grow a crop of longleaf pine reduced as much as 20 percent.

Oak wilt is currently the most highly publicized tree disease in the Nation. Since it is a virulent killing disease to which all oak species tested are susceptible, it deserves the attention it is receiving. There is strong evidence that it has been in Wisconsin and Iowa for 40 years or more. More recently, it has been found scattered over a wide area in the Lake and Central States, from Pennsylvania to North Carolina, and westward through Tennessee and northern Arkansas to eastern Kansas and Nebraska. Oak wilt has destroyed great numbers of oaks in the Middle West; in Wisconsin and Iowa, many oak areas from a few to about 100 acres in extent have been practically denuded. The wilt has been slowly but definitely spreading in the Appalachians and Pennsylvania. In terms of current impact on our Nation's oak supply, oak wilt has not had a great effect (table 128), and its importance lies in the threat that, if left uncontrolled, it could gradually build up to serious proportions over much of our oak timberland.

Sweetgum blight is a newly recognized disorder of unknown cause, characterized by dieback of the crown and more or less rapid death of entire trees. It occurs in varying degrees in all States where sweetgum grows. A particularly spectacular dying of sweetgum that has been taking place in recent years in Maryland and Delaware may be an aggravated stage of the blight that occurs elsewhere in the South or may prove to be a separate disease. The 42 million board-feet of damage from sweetgum blight is made up of the two types combined.

Elytroderma needle cast is a serious disease of

ponderosa pine through southern Idaho and eastern Oregon, and small outbreaks are currently active elsewhere in Idaho, as well as in parts of Washington, Montana, and California. During the past 8 years, it has killed outright at least 46 million board-feet of high-quality timber in the Pacific Northwest and has transformed thousands of good trees into high risks likely to succumb to insect attack.

Miscellaneous diseases not listed individually, through their attacks in 1952, had an impact on growth of over 2,300 million board-feet. This is 12 percent of the impact from all diseases. The group includes many stem rusts, root rots, leaf and needle diseases, and forest losses from such epidemic diseases as the Dutch elm disease, phloem necrosis of elm, and persimmon wilt.

Advances Being Made in Disease Control

Disease Surveys, the First Step Toward Control

Forest disease surveys are essential to learn what diseases we have and something of their importance, to detect new threats, to appraise the extent and damage of known diseases as an aid in planning, and to delimit outbreak areas for control purposes. For the initial detection of new disease threats, considerable dependence is placed on the ever-growing field force of foresters, pathologists, other specialists, and woods workers.

Appraisal surveys, so essential to gage the scope of attack and the possibilities for and costs of control, received great impetus with the passage of the Forest Pest Control Act of 1947, the functioning of which is explained in the final part of this section. The appraisal survey program has been successfully applied to oak wilt, pole blight, larch canker, sweetgum blight, and birch dieback.

However, appraisal surveys do not meet the full needs of control planning, estimation of damage, and the determination of research required. Control surveys are therefore made to locate the stands or trees requiring treatment. They led to the control of larch canker in New England, and are in wide use in the blister rust control program and in the suppression of oak wilt in the Eastern and Southern States. The States have played a vital part in the financing and operation of the blister rust and oak wilt surveys, and are assuming a major role in forest pest detection and survey in general.

Direct Control Necessary Against Some Diseases

In the sense that it is used here, direct control refers to efforts and expenditures made specifically and solely for controlling a given disease, and not those activities worked in as a part of normal silviculture. Most current forest disease control is considered indirect in that it is effected through adjustments in forest management. Of the few current programs of direct disease control, the largest, by far, is the blister rust program. Three of the eight native white pines in the United States—eastern and western white pines and sugar pine—are being protected against blister rust.

Federal, State, and private agencies cooperate in blister rust control. Federal funds are made available to the Department of Agriculture for overall leadership, coordination, and technical direction, and for control on national-forest and non-Federal lands in cooperation with State and private agencies. The Department of the Interior receives Federal funds for Indian, national park, and other lands under its supervision. Satisfactory control involving the removal of currant and gooseberry plants, the alternate hosts of the disease, from the control areas has been established and is being maintained on three-fourths of the Nation's primary white pine areas. The remaining one-fourth includes high-hazard areas in the northern Lake States, Idaho, and parts of Oregon and California.

Several States east of the Mississippi River have active oak wilt control programs, some of which are in cooperation with the Federal Government. The tree removal and treatment phase of this program was, in 1952, carried on entirely by the States.

Prescribed fire is now widely used in the South to control the brown spot in longleaf pine seedlings. When properly used, these fires consume diseased foliage with little damage to the trees, checking subsequent infection long enough to stimulate growth. Since such burns also reduce the forest fuel, reduce grass competition, and at least temporarily improve spring forage, only part of their cost is chargeable to brown spot control.

Only recently have large-scale attempts been made to control dwarfmistletoe by cutting infected trees, although the effectiveness of mistletoe elimination as a means of control has been apparent for several years. In 1952 the Federal Government supported such a program on some of the national park and Indian lands of the Southwest.

Some larch cankers, in addition to those found and removed following discovery of the disease in 1927, were found by disease survey crews in 1951 and 1952. The infected trees were destroyed.

Other current direct control of forest diseases includes small-scale efforts against a large number of diseases both in plantations and natural stands.

The expenditures for the *direct* control of forest diseases in 1952 totaled $3,857,300, approximately

80 percent of which was spent by the Federal Government (table 129). Ninety-seven percent of this Federal expenditure went to the blister rust program. Of the States' share, 80 percent went to blister rust, 13 percent to oak wilt, and the remainder to other diseases. The Nation's effort in forest disease control cannot be appraised fairly by the expenditures listed in table 129, since these were only the *direct* costs and were made largely for the control of one disease.

TABLE 129.—*Expenditures for direct control of forest diseases in continental United States, 1952*

Disease	State and private	Federal	Total
	Dollars	*Dollars*	*Dollars*
White pine blister rust	608, 700	2, 995, 000	3, 603, 700
Oak wilt	101, 700	25, 900	127, 600
Brown spot of longleaf pine	17, 000	34, 800	51, 800
Dwarfmistletoe	0	19, 000	19, 000
Fusiform rust of southern pines	8, 900	600	9, 500
Larch canker	200	6, 200	6, 400
Miscellaneous diseases	23, 800	15, 500	39, 300
Total	760, 300	3, 097, 000	3, 857, 300

Control Through Silviculture Gaining Ground

As has been mentioned, most control efforts are predicated on adjustments in forest management practices. The impacts of many of the diseases listed in table 128 can be materially lessened through corrective silvicultural measures.

Heart rots are major factors in determining the best rotation age for many species, particularly when they become critical at early ages, as in aspen and balsam fir. The changed cull status between the old unmanaged southern pine timber and the younger second-growth forests of today indicates the relation between overage and heart rot, since cull in the old timber usually made up over 20 percent of the volume, while the mean southern pine rot cull in 1952 was estimated at only 3 percent.

Butt rot losses are being curtailed through fire protection and greater care in logging. Trunk rots are being checked by reducing logging damage, removing high rot-risk trees in partial cuts, making salvage cuts in badly damaged stands, pruning in the case of ponderosa pine, and, with some highly rot-susceptible species, adjusting rotation ages to minimize decay loss. Much of the merchantable volume lost to heart rots and sap rots can be reduced only through judicious scheduling of salvage operations.

Dwarfmistletoe damage can be checked by removing the parasite from the overstory in the course of harvesting, and taking out small infected trees in stand-improvement operations. Such operations can also reduce losses from many other diseases, including fusiform rust and the hardwood cankers. Although there has been a gradual increase in stand-improvement measures for disease control, they are not yet in wide use.

A beginning has been made toward replacing shortleaf pine with other species on the soils where the littleleaf disease prevails. In deciding on the proper spacing in slash and loblolly pine plantations, the high incidence of fusiform rust in the wider spacings is an important consideration. Maintaining high-stand density reduces Hypoxylon canker losses in aspen. Even with blister rust, forest-management practices have a direct bearing on control and offer great promise for the future.

Some diseases have killed such large concentrations of timber that it has been profitable to conduct salvage operations. About 32 percent of the chestnut killed by the blight over a dozen States has been salvaged, and dead chestnut is still being utilized. Most of the ponderosa pine recently killed by Elytroderma on the Ochoco National Forest was salvaged. Many cankered eastern hardwoods are used annually for mine props and other uses. Heavily mistletoe-damaged ponderosa pine is often salvaged in the Southwest. On many of the larger forest properties in the Piedmont of the Southeast and in the northern half of Alabama, most of the timber cutting consists of salvaging littleleaf-diseased trees before they die.

There are many major gaps in our knowledge of disease behavior and control in connection with most of our more important diseases. New weapons in the fight against tree diseases comparable to the antibiotics in medicine, and DDT and other comparable insecticides in entomology, are not available against forest diseases. Only research can lead to such new developments.

STATUS OF PROTECTION FROM INSECTS

Insects are among nature's most active killers of forest trees. To the extent that they sometimes thin overdense young stands or kill decadent and suppressed trees, they may be considered beneficial. But beyond this they injure useful trees and sometimes develop devastating epidemics. How to prevent or control insects and utilize much of the vast amount of timber they kill every year are major forestry problems as yet largely unsolved.

Outright killing by insects may be endemic or epidemic in character. Endemic mortality is normal to a forest and is unlikely to be materially reduced except by forest management that changes the composition, age, or character of the stands.

Periodically, insect epidemics kill large quantities of timber. Bark beetles, by girdling trees and by introducing lethal fungi, are especially serious agents.

Next to killing trees, the most important effect of insects on the timber resources is growth reduction. Cone and seed insects may deplete seed crops. Insects may wipe out young stands or seriously injure plantations. Twig and terminal insects may impair growth rates or ruin the form of trees. Defoliators, by destroying the needles or leaves, may devitalize trees and seriously reduce growth and productivity. Insects also destroy usable wood by boring into the sapwood or heartwood and by introducing stains and decay which result in cull and degrade.

Since 1900 many major forest insect outbreaks have killed timber over vast areas. Six catastrophic outbreaks are shown in table 133, p. 217. These accounted for over 52 billion board-feet of softwood timber. An additional 12 billion board-feet of timber are known to have been killed during this period in other outbreaks of lesser size, and probably twice this much has been killed in small outbreaks which were not recorded.

TABLE 130.—*Mortality from insects compared with growth loss, by section of the United States and Coastal Alaska, 1952*

GROWING STOCK

Section	Mortality	Growth loss	Growth impact
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*
North	65	333	398
South	112	251	363
West	796	180	976
Coastal Alaska	27	14	41
Total, United States and Coastal Alaska	1, 000	778	1, 778

SAWTIMBER

Section	Mortality	Growth loss	Growth impact
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*
North	99	1, 315	1, 414
South	412	1, 049	1, 461
West	4, 432	1, 137	5, 569
Coastal Alaska	98	75	173
Total, United States and Coastal Alaska	5, 041	3, 576	8, 617

Insect Impact on Timber Growth

Insects killed more timber than any other agency in 1952. They were responsible for 28 percent of the growing-stock mortality and 10 percent of the national growth loss. The total growth impact to growing stock was 16 percent of that from all destructive agencies, or 1,778 million cubic feet (table 113, p. 189). Growth impact on sawtimber was 8,617 million board-feet, 20 percent of the national total.

The West led with 55 percent of the total insect losses to growing stock and 65 percent of the sawtimber losses for all regions (table 114, p. 190). The North and South suffered almost equally.

Unlike the losses from all other agencies except weather and miscellaneous causes, the mortality from insects exceeded the growth loss from insects for the country as a whole. This was due to heavy mortality in the West (table 130). On growing stock in the North and the South, growth loss exceeded mortality by five and two times, respectively.

Important Timber Losses Caused By Many Types of Insects

Bark beetles, the most important single group of forest insects, killed 4½ billion board-feet of sawtimber in 1952, accounting for 90 percent of the insect-caused mortality of sawtimber and 63 percent (table 131) of the growth impact. In the West, bark beetles attack mostly mature and overmature timber. Nationally, their damage is measured largely in terms of mortality rather than growth loss; in 1952, 84 percent of their damage was mortality.

The western pine beetle, during a 25-year period from 1921 to 1945, probably killed 25 billion board-feet. The mountain pine beetle decimated lodgepole pine stands for hundreds of miles along the Continental Divide in Idaho and Montana between 1911 and 1935. The amount of timber killed has been estimated at 15 to 25 billion board-feet. The mountain pine beetle is also estimated to have killed 10 billion board-feet of ponderosa pine, western white pine, and sugar pine between 1910 and 1950.

One of the most spectacular outbreaks was that of the Engelmann spruce beetle, which destroyed nearly all of the spruce and some lodgepole pine over hundreds of square miles of western Colorado between 1940 and 1951. About 5 billion board-feet were destroyed, very little of which has been salvaged as yet. A new outbreak of this beetle started in 1950, and threatens to kill all of the mature spruce on seven national forests in Idaho and Montana.

Another recent major outbreak is that of the Douglas-fir beetle. Following a serious blowdown in western Oregon and Washington, this insect killed 3 billion board-feet of Douglas-fir. Currently, epidemics of this beetle are prevalent throughout the range of Douglas-fir.

Bark beetles have killed large volumes of southern pine timber over the years. Several

TABLE 131.—*Growth impact by major insects on commercial forest land in the United States and Coastal Alaska, 1952*

Insect	Impact on growing stock					Impact on sawtimber					
	North	South	West	Coastal Alaska	Total, United States and Coastal Alaska	North	South	West	Coastal Alaska	Total, United States and Coastal Alaska	Proportion of total impact
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Percent*
Bark beetles:											
Fir beetles	------	------	537	------	537	------	------	3, 148	------	3, 148	36. 5
Pine beetles	------	101	224	------	325	------	434	1, 238	------	1, 672	19. 4
Spruce beetles	6	------	97	------	103	28	------	524	------	552	6. 4
Other	------	------	7	------	7	2	1	40	------	43	. 5
Defoliators:											
Spruce budworm	1	------	53	------	54	2	------	290	------	292	3. 4
Other	190	33	13	12	248	768	119	64	62	1, 013	11. 8
Miscellaneous [1]	201	229	45	29	504	614	907	265	111	1, 897	22. 0
Total, all insects	398	363	976	41	1, 778	1, 414	1, 461	5, 569	173	8, 617	100. 0

[1] Chiefly hardwood borers, white pine weevil, tip moths, cone and seed insects, spittlebugs, and aphids.

species of beetles in 1952 were responsible for more than 400 million board-feet of mortality and growth losses in this section. Less spectacular than some of the western epidemics, the ravages of the southern pine, black turpentine, and *Ips* engraver beetles have nevertheless been substantial. Some other important bark beetles are the fir engraver and pine engraver beetles in the West and the eastern spruce beetle in the North.

Defoliators were second to bark beetles in the amount of damage caused by insects in 1952. They accounted for 17 percent of the impact on growing stock and 15 percent of the impact on sawtimber.

Defoliating insects reduce the growth of trees by destroying the foliage. Prolonged and severe defoliation of conifers often results in the killing of large numbers of trees. In general, hardwoods can stand more defoliation than conifers, and even several defoliations may not result in substantial tree killing. Thus, 98 percent of the total growth impact on sawtimber from defoliation was loss of growth.

The defoliators include a few well-known species and a large number of miscellaneous ones. The spruce budworm, widely distributed through the true fir and spruce forests of this country and in Canada, has periodically caused heavy losses. The outbreaks in New England and the Lake States between 1910 and 1926 killed about 14 billion board-feet of balsam fir and spruce. In 1952, epidemics were in progress in New England, throughout the Rocky Mountain States, and in the Pacific Northwest. The budworm's 1952 growth impact is estimated at 54 million cubic feet of growing stock, including 292 million board-feet of sawtimber.

The gypsy moth is an introduced insect that has been a pest in the woodlands of New England for many years. It prefers oaks, and during outbreaks may defoliate hundreds of thousands of acres of oak in a single season. Average expenditures of $1,893,000 a year for the past 20 years by the State and Federal Governments have helped to curtail the moth. The total growth impact for 1952 is estimated at only 16.3 million cubic feet of growing stock.

Tent caterpillars kill very few trees but reduce growth considerably. For 1952, this loss was estimated at 170 million cubic feet of growing stock, including 743 million board-feet of sawtimber.

Additional important defoliators in 1952 were pine sawflies, larch sawflies, the hemlock looper, and the fir looper.

Miscellaneous insects are chiefly those listed in the footnote to table 131. Though miscellaneous they are not minor, for they account for 22 percent of the growth impact on sawtimber.

A New Age in Insect Control

Surveys Are Basic to Detection and Control

Surveys to appraise the importance and distribution of many forest insects have been made through the years. However, it was not until passage of the Forest Pest Control Act by Congress

in 1947 that nationwide efforts were possible. Under this act, surveys reaching into all of the forested regions of the country have been initiated. These are designed to help detect serious insect and disease outbreaks, and to appraise their magnitude and trends, so that prompt control measures can be taken.

Appropriations have been made available under the act for forest insect and disease surveys on Federal forest lands and for cooperation with the States and private timber owners in expanding survey coverage to all ownerships. The detection of outbreaks is recognized as the primary responsibility of the landowner, while such technical supervision and guidance as may be needed is usually furnished by Federal leadership.

When Federal financial aid is requested for control, the Forest Service appraises the extent and importance of insect and disease outbreaks that are deemed serious enough to warrant control action, and estimates the cost of control. The Service provides technical supervision for control projects involving Federal participation and checks the results of control. Assistance in the detection phase of the program is given by other Federal land-managing agencies, by the State forestry services, and by private timber owners. Surveys were run in 1952 on many outbreaks, among the more important of which were those caused by the Douglas-fir, Engelmann spruce, western pine, and southern pine beetles, the spruce budworm, and the larch sawfly.

The importance of detection surveys in a program of protection from insect outbreaks has been recognized by States and by private timber owners. In many parts of the country forest pest control action councils have been organized to encourage adequate surveys and the participation of private timber owners in control work.

Most Major Insects Now Combated by Direct Measures

The protection of timber resources from forest insects can be accomplished either by the prevention of outbreaks, their direct control, or the reduction of losses through a program of salvage and utilization. During the past 10 years, many new materials and methods for killing destructive forest insects have been developed. For the control of certain bark beetles, penetrating oil sprays have been used successfully on large-scale control projects that would previously have been too costly to undertake. Aerial spraying and new insecticides such as DDT, developed during World War II, have made possible the effective control of defoliators over large areas at low cost. Following DDT came other new synthetic insecticides that have proved effective in the control of many forest insects. Recently, the direct control of forest insects through aerial sprays or the application of insecticides to the bark of infested trees has reached considerable magnitude and effectiveness.

Destruction of beetle populations through burning or spraying bark has been at least temporarily effective in many cases. Epidemics are also often controlled by some natural factor, or come to a halt through the depletion of susceptible host material.

The emergency and temporary character of most direct control is well recognized, and efforts are being directed towards developing effective biological control and in managing forest stands so as to make them more resistant to insect attacks. Unfortunately, the development of satisfactory control methods of these kinds is very slow. Meanwhile, it will often be necessary to continue with direct control methods to prevent excessive losses.

Forestry agencies in many areas of the country are now organized to handle direct control programs. In 1952 Federal funds helped finance a major share of the cost of 12 large insect-control operations and many smaller insect and disease projects throughout the country. On at least four of the large operations, State and private funds were raised to share in the project costs. The other projects were wholly on national-forest or national-park lands, and the full cost was met by the Federal Government. The Forest Service furnished plans and technical supervision, but the projects were administered by the land-managing agency most concerned.

Where substantial acreages of private or State lands were involved, control was carried out under the cooperative provisions of the Forest Pest Control Act and complementary State forest pest control laws. Most States with substantial amounts of forest land have passed legislation authorizing appropriate State officers, such as the State forester, to control forest pests. In general, authority is granted to declare forest pests a public nuisance and require landowners to dispose of such pests either by themselves or with the help of State and Federal authorities.

Where the Federal Forest Pest Control Act applies, the Federal Government can pay a part of the cost of control, usually not more than 25 percent, on State and private lands. Where control work on private land is done in accordance with State authority, the costs may be met in part by State funds. The act is not mandatory or regulatory. It has been of great help in unifying methods and coordinating action.

Forest insect control expenditures in 1952 by State, private, and Federal agencies totaled \$3,595,500 (table 132). Gypsy moth control made up nearly half of this total. Most of the remaining expenditures were for the control of the spruce budworm, Engelmann spruce beetle, and pine beetles in the West and South.

TABLE 132.—*Expenditures for direct control of forest insects, continental United States, 1952*

Insect and section	State and private	Federal	Total
	Dollars	*Dollars*	*Dollars*
Pine beetle:			
South	51, 900	97, 700	149, 600
West	37, 700	136, 600	174, 300
Engelmann spruce beetle:			
West	5, 000	691, 100	696, 100
Spruce budworm:			
West	147, 000	594, 600	741, 600
Gypsy moth:			
North	972, 000	800, 000	1, 772, 000
Other Defoliators:			
North	1, 900	2, 150	4, 050
South	13, 000	3, 100	16, 100
West	800	4, 200	5, 000
Miscellaneous:			
North		9, 550	9, 550
South	18, 000	5, 500	23, 500
West		3, 700	3, 700
Total	1, 247, 300	2, 348, 200	3, 595, 500

Biological Control—A New Tool Against Forest Insects

Efforts have been made to hasten forest insect control through artificial propagation of their natural enemies. In the case of introduced pests, such as the gypsy moth, conspicuous success has followed the introduction of its natural parasites. Recently, effective control of the European pine sawfly has been obtained by ground and aerial spraying with an insect virus disease.

Insect Control Through Silvicultural Modifications

Another promising method of controlling native forest insects is through silvicultural techniques or forest-management practices. By modifying the stand so as to make conditions less suitable for insect attack, some insect damage can be prevented.

Studies of the spruce budworm in balsam fir stands have indicated that losses are most serious in mature and overmature stands, and where a high percentage of balsam fir occurs. This suggests that losses might be reduced by operating balsam fir stands on a shorter cutting cycle and by reducing the percentage of balsam in mixed stands. Attacks by the white pine weevil appear to be less serious where the white pine is grown in dense stands for the first 20 years or so, or in mixture with hardwoods, particularly where the pines are partially suppressed by the hardwoods.

Some bark beetle outbreaks have developed in the host material provided by fires, windfalls, slashings, and drought. To the extent that these conditions can be controlled, or the weakened and killed timber promptly salvaged, beetle losses can be diminished.

Among the bark beetles, control through forest management has been developed satisfactorily for the western pine beetle and the Jeffrey pine beetle in the interior ponderosa pine type. It has been amply demonstrated that cutting and removing trees with the highest beetle risk, usually from 15 to 25 percent of the stand, will effectively control these beetles for periods up to 15 years, even though neighboring stands remain infested. This method of prevention or indirect control has entirely supplanted direct methods of controlling these beetles on commercial forest lands where logging is feasible.

There is much need for research to develop forest-management practices that will reduce or control damage by insects. So far, only the first steps into this broad field of control through modified silviculture have been taken. There will still be a need for direct or biological measures of control for those destructive forest insect species that do not depend upon adverse forest conditions for the success of their outbreaks. Recent trends have been away from sole reliance on direct control methods, and toward giving greater emphasis to biological and silvicultural control techniques.

So much remains unknown concerning the habits of forest insects, the factors governing outbreaks and their duration, and methods of control that progress in insect control through silviculture is closely related to research progress in forest entomology in general.

Opportunities for Salvaging Insect-Killed Timber Improving

The 5 billion board-feet of timber killed by insects in 1952 is made up of two components: First, the yearly endemic loss that is more or less evenly distributed throughout the entire forest area. This comprises probably two-thirds of the total, or 3.3 billion board-feet. Second, the epidemic losses, which are more or less concentrated, comprise the remaining one-third, or about 1.7 billion board-feet. Much of the latter, at least, could be salvaged for commercial use.

Large volumes of insect-killed timber have recently existed in certain areas. These include 5 billion board-feet of spruce devastated by the Engelmann spruce beetle in western Colorado, 12 billion board-feet of Douglas-fir in Oregon and Washington killed by wind and bark beetles, and another 3.7 billion of recently killed Douglas-fir in the Northern Rocky Mountain Region. A high percentage of the present mill capacity in these areas is operating on insect-killed timber, but is able to utilize only a small part of the total.

In many parts of the country, lumber companies are now gearing their operations to salvaging insect-killed timber. Added access roads are needed to make this large amount of salvable timber more readily available and in some cases added mill capacity is necessary.

THE IMPACT OF ANIMAL DAMAGE ON TIMBER GROWTH

Many kinds of wildlife, as well as domestic cattle, sheep, and hogs, damage timber. The combined effect of these animals and birds can be the limiting factor in successful regeneration of some timber stands. In almost all cases where important damage to timber was caused by animals, such damage was the result of excessively dense populations.

The total growth impact of animal damage on commercial forest land in 1952 is estimated at 1,009 million cubic feet of growing stock, including 2,722 million board-feet of sawtimber (table 113). This damage constitutes 9 percent of the total impact to growing stock, and 6 percent of the impact to sawtimber. Only a little is direct tree mortality, 93 percent being due to unsatisfactory reproduction and inhibited growth (fig. 72). About 86 percent of the animal impact on growing stock and 90 percent of the impact on sawtimber occurred in the North (table 114).

Many Kinds of Animals Impede Growth and Regeneration

The nature of damage by animals varies in different parts of the country. In the Southwest, the loss of forest values caused by the grazing of domestic animals, partially from browsing of seedlings but primarily from site deterioration on overgrazed lands, is a serious problem in some localities. Browsing by livestock is common in many parts of the South. Such damage also occurs through the use of farm woodlots by dairy cattle, particularly in the North. Livestock in some areas have not only injured and destroyed many young trees by browsing and trampling, but excessive use has accelerated erosion, resulting in lowered site quality through loss of soil, increased soil temperatures, and more rapid losses of soil moisture.

In the South, hogs have prevented thousands of acres from restocking naturally to longleaf pine. Hogs eat the roots of seedlings, destroying both planted and natural stock.

Big-game damage is caused primarily by deer, but in a few limited areas, principally in the West, elk and moose have seriously damaged aspen reproduction and conifers through excessive browsing. Forest damage by deer occurs principally in the Lake States, the Middle and North Atlantic States, and in the Rocky Mountains. It is ordinarily greatest in the North during the winter, when snow confines deer herds to small areas, but in areas with excessively high deer populations, summer range has also been affected.

Deer sometimes interfere with the establishment of forest reproduction by browsing the terminal shoots and side branches. Continued heavy browsing can result in deterioration of timber stands through the elimination of the more palatable species and dominance of species that are less palatable. An example is the transition from maple and ash to blue beech, ironwood, and beech in many areas in the Middle Atlantic States. Less common is the damage caused by big-game animals through bark peeling and antler rubbing.

In the Olympic Peninsula of western Washington, in western Oregon, and in California, bears damage or kill young timber during spring and early summer by stripping bark and eating the succulent cambium layer. It has been estimated that one California lumber company has recently been suffering bear damage of 700 to 900 board-feet per acre per year over 53,000 acres. Damage tends to be concentrated in small areas and is serious only in second-growth stands.

Rabbits damage commercial forest stands mainly in the Lake States, New England, and in the Pacific Northwest. They clip shoots and nip off or girdle the main stems of reproduction, thus retarding stand establishment and causing forked stems and bushy trees. Where rabbits are numerous they are a serious threat to the success of Douglas-fir and pine plantations in the Pacific Northwest and in California.

Porcupine damage occurs mainly in the West and the North, and mostly in the winter, when porcupines feed on the inner bark and cambium layer of young pines and northern hardwoods. They girdle small trees near the ground, but on larger trees they feed in the upper portion of the bole. The principal damage consists of partial or complete girdling of the trunk and branches. Some saplings and poles are killed outright. Often growth is reduced and many trees are deformed or weakened and made susceptible to insects and disease.

Throughout their range, beavers kill trees for food and build dams that flood stands. The damage, however, is usually limited to small areas and is not an important factor in timber management.

Forest tree seeds, particularly of conifers, are important food for many small mammals and birds, and the impact on establishment of tree reproduction can be severe. The most widespread and important seed-eating mammals are the white-footed mice, tree squirrels, and chipmunks, but there are many others. Many species of birds also feed on tree seeds. Tree squirrels are particularly heavy consumers of coniferous seeds

and may take 70 to 75 percent of the seed crop in some areas. They also bite off cones, sometimes before the seed matures.

White-footed mice, because of their fondness for tree seed, their wide distribution, and their fecundity, are sometimes the most important single factor limiting successful forest regeneration, particularly in the Pacific Northwest. Favorable habitat conditions for these mice are created as a result of fire and slash burning. The new vegetation appearing on such areas provides abundant food and results in a buildup of the mouse populations. The increased animal pressure often leaves little opportunity for successful natural or artificial seeding.

Animal Damage Can Be Controlled

The only feasible means of reducing and controlling forest damage by livestock and big game is through good range practices and game management. These animals are not incompatible with timber production if they are managed on the basis of proper utilization of key forage plants.

Control of forest damage requires the establishment of specific carrying capacities in a multiple-use forest. Thus where game animals are damaging their habitat, hunting seasons should be liberalized and the harvest of surplus animals by sport shooting encouraged in order to maintain desirable numbers. Proper multiple-use forest management also often requires that silvicultural practices be modified to maintain desirable game habitats. In most areas where game problems have developed, progress is being made toward obtaining proper livestock and big-game herd management.

Fencing can be used to exclude larger animals from small areas, but its cost is so high that it can seldom be justified as a means of controlling big game on large areas. Where high-value tree crops are at stake, however, it is sometimes practical to control domestic livestock by fencing.

Control of small rodents is extremely difficult, largely because populations recover rapidly. Poisons have been effective on small areas, but the costs are high, and trapping on large areas is not practical. Moreover, recent studies indicate that certain seed-eating rodents, particularly deer mice, consume large numbers of certain insect enemies of forest trees. Seed to be sown directly in the field may be coated with substances that repel rodents and perhaps birds also. Several such preparations hold promise but have not yet been fully evaluated.

The porcupine's conspicuousness, slow gait, and dependence on quills for protection makes control by clubbing or shooting easy, and systematic hunting is justified where porcupine concentrations are heavy or especially valuable stands are being damaged. Trapping, baiting, and fencing may also be effective.

Reducing snowshoe hare populations is not often practical except in small areas. Nursery seedlings to be planted in hare habitats can be treated with repellents, but will be protected only until new growth develops.

Beaver can be controlled by trapping. Most States rigidly control beaver trapping, so that beavers doing damage must be removed by State employees or licensed trappers.

The obvious method for control of deer, bear, and other big-game animal populations that have grown to a point where they are causing damage to their food supply is through liberalized hunting seasons.

Records indicate that less than $100,000 was spent in 1952 to control animal damage to forest stands. This was mostly for controlling hogs in the South and rodents and bears in the West.

WEATHER EFFECTS DESTRUCTIVE TO TIMBER

Weather damage in 1952 resulted in a growth impact of 957 million cubic feet of growing stock, including 3,869 million board-feet of sawtimber. This was 9 percent of the total national growth impact from all sources (table 113). The loss, like that from fire, varies considerably from year to year, especially in certain regions. In 1952, 88 percent was outright mortality (fig. 72).

Growth impact in the West resulting from adverse weather in 1952 was primarily from storms and far exceeded the weather losses in the North and South combined (table 114). In the Pacific Northwest, where some of the great historical blowdowns have occurred, mortality from storms exceeded that from any other cause, making up 40 percent of the regional mortality. In this region alone, 1,613 million board-feet of timber was lost, largely from wind. In the Northern Rocky Mountain Region, wind caused mortality that was exceeded only by insects. Wind is periodically important in all of the western regions. It prostrates trees over great acreages, blows down root-rotted trees especially, and sets the stage for insect attacks and fire.

Hurricanes are frequent in much of the South, and in recent years have occasionally been damaging throughout all of the States bordering the Atlantic Ocean and the Gulf of Mexico. Tornadoes are an annual occurrence in the South, but, unlike hurricanes, they usually cause damage in only a very narrow path. Ice, frost, hail, and snow cause periodic losses in the West, in the entire North, and southward through the Appalachian Mountains. An important damaging aftereffect of ice storms is the heart rot that develops from limb and top breakage.

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Lightning causes notable damage in many regions but is probably worst in the Southern Rocky Mountain Region. The loss of individual trees by lightning strikes is minor compared to the fires and bark beetle infestations that so often follow. Lightning also exposes trees to attack by oak wilt and other diseases.

Drought causes important losses periodically in most regions, with California, the Southern Rockies, the Plains, and the South suffering the most frequently. Pine plantations were damaged extensively during the 1952 drought in the South. When the full effects of droughts are known, the damages ascribed to them may be increased. Some maladies of unknown cause, such as birch dieback and sweetgum blight, and attacks by some insects, such as the southern pine beetle, may prove to be brought about primarily by drought.

Other weather-induced losses are caused by rock and snow slides, hot winds in the West, and by a variety of other disturbances.

There are some opportunities for reducing losses from weather damage. Harvest cuts can be regulated to leave sufficient trees properly spaced and in patterns that help reduce blowdown. Logging of steep areas can be minimized to avoid snow and earth slides following heavy rains. Forest composition can be regulated toward wind- or ice-resistant species. The reduction of loss following damage from extreme weather conditions is, however, largely a matter of salvage.

Where weather damage is sporadic and light, there is little opportunity for salvage unless the killed timber is readily accessible to current logging operations or the area is under intensive management. Where weather-damaged timber is concentrated and of high value, there is usually a greater opportunity for salvage, provided that logging operations are shifted into the damaged timber and that access roads are built before the timber values decline. One of the significant advantages of prompt and thorough salvage is the reduction of insect outbreaks that often move into adjacent undamaged timber.

Recent wind damage in the West has been in rugged timbered areas requiring a large investment for access roads. In the Northern Rocky Mountain Region, for example, an appropriation of $9,000,000 was obtained in 1953 to build roads to 365 million board-feet of timber blown down on national-forest lands in 1949. An even larger road construction program to salvage windthrown and insect-killed timber on public lands in the Pacific Northwest has been found necessary by both private and public agencies. Most private land in the West is more accessible than the public forests, which contain vast inaccessible areas on which millions of board-feet of killed timber go to waste annually because of lack of roads. A greatly stimulated access road program is needed for these areas.

In the North and South, accessibility is good enough to make major salvage operations generally feasible. In the New England hurricane of 1938, almost half of the timber killed was salvaged. Salvage from storm damage usually requires quick opportunities for use of the wood, ready access, and mill facilities to handle unexpectedly large quantities of killed timber.

CATASTROPHIC TIMBER DESTRUCTION SINCE 1900

Every so often, the timber destroyed by fire, insects, disease, or wind is so great that the event is considered a catastrophe. For the purpose of this Timber Resource Review, a catastrophe is defined as an *unpredictable event* characterized by a combination of *unusual severity and concentrated loss* in both time and area and of sufficient magnitude to cause major dislocation of forest management or timber utilization in the region affected. The Tillamook burn of 1933, the New England hurricane of 1938, the Engelmann spruce beetle destruction in Colorado between 1940 and 1951, and the chestnut blight are examples of the sort of events considered catastrophes in this report. When fire or weather is the cause, the damage is usually done within a single year. Losses from insects and disease usually take more than a year to reach catastrophic proportions.

In estimating our capacity to meet future timber needs, allowance must be made not only for the largely expected or reasonably predictable losses from destructive forces, but also for the unpredictable catastrophic losses that will undoubtedly occur at intervals in the future. As table 133 indicates, catastrophes since 1900 have killed more than 122 billion board-feet, of which approximately 16 billion were salvaged. Thus the net timber loss from these events is estimated to average over 2 billion board-feet a year.

Insects have been the greatest single cause of catastrophic loss. Their outbreaks have destroyed more than 52 billion board-feet since 1900. Fire killed nearly 32 billion board-feet. Wind killed over 19 billion, and disease 18 billion board-feet.

The West, with a net catastrophic loss of 79 billion board-feet since 1900 (table 134), had 72 percent and the East 28 percent of the total catastrophic loss. This difference is probably due mainly to the larger volumes of timber per acre in the West and the more extensive areas of virgin forest: virgin stands are particularly susceptible to insect attack, wind, and fire.

Three catastrophic fires are listed in table 133. These are the Yacolt fires of 1902, the Idaho-Montana fires of 1910, and the Tillamook burn of 1933. The famous Cloquet fire of 1918 in

TABLE 133.—*Catastrophic timber destruction in continental United States since 1900*

Major cause	States	Date	Approximate volume killed	Approximate volume salvaged	Proportion of killed volume salvaged
			Million bd.-ft.	*Million bd.-ft.*	*Percent*
Insects:					
Spruce budworm	New England	1910–19	8, 000	900	
Spruce budworm	Lake States	1913–26	5, 800	(1)	
Mountain pine beetle	Idaho-Montana	1911–35	15, 000	50	
Western pine beetle	Oregon	1921–37	12, 600	(1)	
Western pine beetle	California	1931–37	6, 000	(1)	
Engelmann spruce beetle	Colorado	1940–51	5, 000	[2] 29	
Total			52, 400	979	2
Fire:					
Yacolt fires	Washington	1902	12, 000	1, 000	
Idaho-Montana fires	Idaho-Montana	1910	8, 000	800	
Tillamook burn	Oregon	1933	11, 830	[2] 5, 000	
Total			31, 830	6, 800	21
Wind:					
Olympic blowdown	Washington	1921	5, 000	200	
New England hurricane	New England	1938	2, 650	1, 250	
Douglas-fir blowdown and bark beetle attack	Oregon-Washington	1949–52	12, 000	[2] 1, 000	
Total			19, 650	2, 450	12
Disease:					
Chestnut blight	Northern	1912–24	13, 396	5, 063	
Chestnut blight	Southern	1925–40	4, 757	755	
Total			18, 153	5, 818	32
Total, all causes			122, 033	16, 047	

[1] Salvage nil or no estimate available. [2] Salvage still in progress.

Minnesota was not included because it burned largely on cutover land and hence did not kill a volume of timber comparable to the others. Twenty-one percent of the timber killed in the three fires was salvaged. The greater salvage on the Tillamook burn was made possible by better equipment and accessibility and increased timber values.

Wind has also caused three major catastrophes since 1900. The Olympic blowdown of 1921, the New England hurricane of 1938, and the Douglas-fir blowdown and bark beetle attack of 1949 to 1952 are well known to foresters. Most of the Douglas-fir blowdown occurred in December 1951. Loss from wind tends to be concentrated, and a high percentage of timber thus killed can often be salvaged. Very little of the Olympic blowdown of 1921 was salvaged because of inaccessibility and lack of equipment and markets at that time. Following the New England hurricane of 1938, salvage operations were organized by the Forest Service on an emergency basis and 47 percent of the loss in volume was milled and used.

The recent heavy losses from wind and bark beetles in the Douglas-fir stands of western Oregon have brought about a determined salvage effort by all agencies, Federal, State, and private. One billion board-feet has already been salvaged and the work is still in progress.

Catastrophic insect losses have been spread out over large areas and over periods of many years. As a consequence, the problem of salvage can become a gigantic one. Only 2 percent of the timber destroyed in the insect outbreaks cited in table 133 has been reported as salvaged. The opportunities for salvaging insect-killed timber are increasing considerably and progress is being made in meeting this problem.

The chestnut blight killed the entire commercial stand of chestnut from New England and the Middle Atlantic Regions into the Deep South. Because of the commercial value of the tree, its wide

TABLE 134.—*Catastrophic timber destruction in Continental United States since 1900, by location and period*

Location and period	Timber killed		Killed timber salvaged	
	Approximate volume	Proportion	Approximate volume	Proportion
	Million bd.-ft.	*Percent*	*Million bd.-ft.*	*Percent*
East:				
1900–25	27, 196	22	5, 963	22
1926–52	7, 407	6	2, 005	27
Total	34, 603	28	7, 968	23
West:				
1900–25	25, 000	21	2, 000	8
1926–52	62, 430	51	6, 079	10
Total	87, 430	72	8, 079	9
Total	122, 033	100	16, 047	13

use, its accessibility, and durability, 32 percent of the volume was salvaged.

Fire and wind often increase the losses from insects and disease. The recent Douglas-fir blowdown in Oregon of 10 billion board-feet resulted in an additional 2 billion board-feet of Douglas-fir timber killed by bark beetles. These large areas of insect-killed and blowdown timber greatly increase the chance for a holocaust. Many of the more serious fires in Idaho and Montana have been in areas of early "bug-killed" timber.

Catastrophes by fire, insects, and disease should become largely preventable as we study and learn more about them. With more knowledge, early recognition and prompt control measures may become possible. Little can be done to prevent catastrophic wind damage, but prompt utilization of windthrown trees will do much to minimize loss.

The salvage of catastrophic loss of all kinds is a subject that merits increased attention. Higher timber values, developments in equipment, and expansion of the access road system should serve to speed our rather slow progress in utilizing timber killed in large natural disasters.

THE OUTLOOK FOR REDUCING TIMBER LOSSES

In this report it has been shown that a loss of 44 billion board-feet of sawtimber will result from the destructive events of 1952. This volume equals 93 percent of the net sawtimber growth or 90 percent of the cut in 1952. The losses are of such magnitude that the extent to which they can be reduced will have a significant bearing on our future timber supply. While there is no fully satisfactory basis for establishing longterm trends in growth impact for each type of destructive agency, general trends can be foreseen from study of the data in this report and from knowledge of how fire, disease, insects, and other factors operate.

The annual acreage burned seems likely to decrease. Much of the early gain will be made on lands that are now unprotected, and which are poorly stocked and have been burned repeatedly over the years. Nevertheless, the reduction in the impact of fire on our timber supply will be substantial. Table 135 shows the reductions that are expected by 1960. The estimated reduction for the Nation is 35 percent of the growth impact on growing stock for the recent average year. A large percentage reduction is expected for the North and West, but the major gain will be in the South where, through improved fire control, timber damage should be reduced by more than 460 million cubic feet per year. Much of this gain will come from less basal wounding of hardwoods and reduced destruction of seedlings and saplings. The gains in the West will be primarily through reduction of coniferous sawtimber mortality.

The longer-term outlook, although less definite, is still encouraging. All signs point to fewer man-caused fires, and more intensive fire control, with corresponding reductions in burned area, all of which add up to less timber loss. Certain counteracting factors will operate against indefinite continuation of downward trends in fire losses. As growing stock increases and timber quality improves, the timber values subject to loss by fire will be greater. The tremendously increasing use of forests by the public, greater industrial development, more extensive logging, and similar changes will add to future forest fire risk and hazard. If anticipated gains are to be realized,

TABLE 135.—*Estimated growth impact from fire on commercial forest land in 1960, continental United States*

Section	Impact from 1952 fires	Impact from fires of the average year 1948–52	Estimated impact from fires of 1960	
			Volume	Reduction as proportion of average
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Percent*
North	193	92	44	52
South	1, 378	1, 477	1, 015	31
West	115	235	119	49
Total, United States	1, 686	1, 804	1, 178	35

there must be a continued trend toward better facilities and techniques for control, and more resources to cope with the critical fire periods when most timber losses are sustained.

Many opportunities to reduce losses from forest insects and disease will result from the extension and intensification of the survey and control activities authorized by the Forest Pest Control Act of 1947. This Act authorizes the Secretary of Agriculture to provide for detection, appraisal, and control of insects and diseases on Federal forest lands and provides the basis for cooperating with State and private organizations in detecting and controlling pests on non-Federal lands.

The Forest Service regional experiment stations have been delegated responsibility to conduct insect and disease detection surveys on all forest lands for the purpose of locating abnormal occurrences of pests at early stages. Detection is developed cooperatively by the Forest Service among many State and industrial foresters and private landowners.

The Forest Service technicians in the experiment stations follow up detection reports and make detailed *appraisals* of infestations on all lands. Recommendations on the technical feasibility and soundness of a control project are made in the appraisal report on the basis of the extent, activity, damage, and potential threat of the insect or disease and on the basis of knowledge of control methods. If the outbreak is on federally owned lands, the responsible local land manager recommends for or against a control project after balancing costs against the extent to which losses can be prevented. The State forester performs this function if the insect or disease problem is on State or private lands.

All recommendations for control projects are considered and priorities are assigned for selected projects by the Chief of the Forest Service, who also allots funds appropriated for control work. For projects on Federal lands, the administrative unit of the agency involved plans and conducts the control job with technical assistance from the experiment station personnel. Such jobs are financed entirely from Federal funds. State foresters usually take the lead in planning and conducting control projects on State and private lands but get assistance from industrial foresters and Forest Service technicians.

Contribution of Federal funds in sharing the costs of control on State or private lands is flexible, depending upon circumstances and upon the nature of intermingled land ownership. Under the present policy, 25 percent or occasionally as much as one-third of the cost of a project on State or private lands may be contributed from Federal sources. During the control job, Forest Service entomologists and pathologists give technical guidance as needed to insure proper use of the best control techniques. They make inspections during control operations and conduct post-control surveys to evaluate the effectiveness of the work.

The entire pest control survey activity is relatively new but gives promise of being an effective system where control of losses dictates the need for direct attack upon forest pests.

In other directions there is no question but that progress, although slow, is being made in reducing losses from forest diseases. Since 73 percent of the 1952 sawtimber impact from disease was attributed to the heart rots, gains in reducing their losses would be particularly important. The outlook for major gains in this field is promising in view of anticipated reduction in fire-scarring and logging injury, together with the gradual dying and elimination of badly damaged and decadent timber by cutting, poisoning, or girdling.

Progress is being made in selection and breeding for resistance to blister rust, littleleaf, and other forest diseases. Blister rust control is becoming more efficient with new mechanical and chemical means of Ribes eradication, and oak wilt control methods have been simplified. Large-scale control against dwarfmistletoe has only recently been started. A substantial reduction in disease mortality is expected in most regions during the next half century, provided no serious new killing diseases make important inroads on commercial species.

Although few data are available on which to gage future trends in timber losses from insects, several factors point to an improved situation. More than half of the insect loss today is from mortality in western sawtimber. The amount of insect-susceptible old growth is being steadily reduced and special cuttings to remove potential insect host trees are being extended. Future insect control through silviculture will likely increase in effectiveness as we learn more about insects in relation to their environment. Control of stand composition, to remove susceptible tree species, thinning to proper densities, and the development and use of insect-resistant strains of trees will all aid in reducing losses.

The development of new insecticides to combat both defoliating insects and bark beetles, and new methods of application, have been outstanding in recent years. Continued improvement in both insecticides and methods of use is expected, with extension of better direct control practices to more kinds of insects. Methods of biological control against forest insects have not been fully explored, but the spread of virus and other insect diseases by airplane holds great promise. Wider use of insects that prey on damaging insects is expected.

Although the long-term outlook for the reduction of losses from disease and insects is favorable, such progress will doubtless be gradual, tempered by some setbacks, and measured to a considerable degree by progress in research and by coordinated

and cooperative control efforts among State, Federal, and private timberland owners.

Animal damage to timber should gradually lessen in the future, as a better understanding of animal problems, including animal management and control, is achieved. Free-ranging hogs in the South are in steady decline, controls for rodents are slowly developing, and livestock management on woodland and forest range is improving. Big-game animals, on the increase for many years, are being managed in some parts of the country so that herds are kept in balance with available food. However, many factors will continue to influence intensive big-game management, and it will be difficult to reduce timber damage from deer especially.

When the progress being made in the control of destructive agencies is viewed in the aggregate and the probable results are contemplated, the pattern our forests will follow can be visualized. Lessened damage from fire, disease, insects, and other agencies will result in better stocking of many forest areas now sparsely stocked or bare. Gradually, the numbers of small trees in cordwood and saw-timber sizes will become more plentiful. Less basal wounding will result in reduced decay, and fewer rotten cull trees will be present in our forests. Fewer dead and dying trees will be in evidence, and salvage will be more complete when losses do occur. Thus, if forest protection is accelerated, a substantial part of the heavy current annual losses, amounting to 44 billion board-feet as a result of damage in 1952, can be saved for future use.

Productivity of Recently Cut Lands

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PRODUCTIVITY OF RECENTLY CUT LANDS

Leonard I. Barrett
Lawrence P. Neff
Philip A. Briegleb

INTRODUCTION

The current and future growth in volume of forests is greatly influenced by certain conditions of forest stands after cutting. These conditions can result in maintenance of precutting growth or even an increase of growth. They can also result in growth at very low volumes for many years after cutting. The quality or usefulness of the growth is similarly affected by these conditions.

It is estimated that from 2 to 4 percent or from 10 million acres to 20 million acres of our commercial forest lands are cut over each year to supply the national market for wood products. In 1952, 26.3 billion board-feet of sawtimber or 54 percent of the national total sawtimber cut was derived from commercial lands of the North and South combined. Since almost no virgin timber remains in these sections, a very significant portion of the annual timber cut is thus being supplied from areas cut over at least once. In addition to the sizable portion of our annual supplies derived from eastern areas already cut over, second growth in parts of the West is being cut for timber products. Obviously over half of our annual timber cut is now derived from stands previously cut over.

As cutting in western old-growth areas proceeds, their volume and area will be reduced with the result that even higher proportions of our annual needs for wood must be found on areas previously cut over. Eventually all forest products will necessarily come from timber grown on such areas. Thus the productive condition of cutover [42] lands has an important bearing upon future supplies and the capacity of these areas to supply wood requirements in the years ahead.

This section presents results of a field sampling survey of recently cut lands on all classes of ownership in every region of the country. Because the subject is highly technical and complex, the concepts and procedures controlling the survey are also described in some detail.

The term "recently cut lands" as used in this report refers to those commercial forest areas from which trees were removed for the manufacture of forest products during the period January 1, 1947, to the date of field examination in 1953 or 1954. Excluded from the survey were those areas where cutting was part of a conversion from forest to other use, where cutting was done on noncommercial forest land, and where cutting was incidental to home use on small properties or to construction of roads, bridges, administrative sites, and similar developments on larger private or public forests.

The specific information obtained in the survey and reported on here includes:

1. A productivity classification of recently cut lands by size and type of ownership, geographical location, and forest type group.
2. Identification by ownership class, location, forest type group, and specific condition of recently cut area; and of those recently cut lands having adverse effects upon the national level of growth as compared with those which tend to maintain or increase this level.
3. Related material on residual stand-size class, type of primary products removed in recent cuttings by broad size classes, and the results of an intensified survey on the West Coast.

This information leaves out of direct consideration many phases of forest management. For example, the survey does not appraise the extent to which sustained-yield policies have been adopted by forest owners. Methods of logging, types of improvements, degree of adherence to classifications of cutting practices or silvicultural methods were not measured. The amount of effort expended to attain a given forestry objective is not rated. Only as actions in these phases are reflected by the conditions found on the recently cut lands examined do they influence results.

[42] The term "cutover" as used in this section means those commercial forest areas from which trees were removed for the manufacture of forest products and includes all such areas without qualifications as to the method or intensity of cutting practised.

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Previous Related Appraisals

Interest in the condition of cutover lands has been expressed since the beginning of conservation efforts in the United States. During early stages of forestry development, some landowners and public agencies adopted policies of making cutover area surveys. For several decades a major effort of forest research has been to determine the effects of cutting methods on subsequent growth and to develop methods that would increase growth. There is a voluminous forestry literature, both technical and general, relating to cutover lands. However, for only little more than a decade have there been comprehensive efforts to appraise the condition of cutover lands over broad areas in terms of specific standards or criteria. Only one such effort, the *Forest Reappraisal* of 1946, has been on a national basis.

Surveys of this kind are described briefly below:

1. During 1942–45 Louisiana State University conducted a survey in the loblolly-shortleaf pine type of Arkansas, Louisiana, and Mississippi covering five sample areas typified by small- to medium-sized forest ownerships and published the results as Bulletin 393. This study developed standards which recognized the two elements of species composition and pine stocking. Classifications of these two elements were integrated into a pine stocking index. This index was considered indicative of productive capacity and was related to the number of owners and the total forest area in each ownership type and size class.
2. In 1945 the Forest Service conducted a comprehensive nationwide reappraisal of the forest situation, part of which was a survey of forest practices. Results of this survey were included in the publication *Forests and National Prosperity*, United States Department of Agriculture Bulletin No. 668, 1948, commonly known as the Reappraisal Report. This was the first nationwide attempt to collect and interpret statistical material on forest practices. Cutting practice guides were developed for each major forest type as a median standard. This standard included the numbers of trees of various sizes and species groups needed after cutting to qualify for the median or "fair" cutting practice level. It placed considerable emphasis on the operable volume of timber left on the ground after cutting. However, alternatives to this were provided.

   Additional guides provided means for judging the degree of forestry effort expended on the ownership. Each ownership examined was then classified into one of five levels of practice. These ranged from "high order" to "destructive," with two of the five rating above the median "fair" level and two below. Differences between the standards for "fair" practice and the practices on a particular ownership both as to stand of timber left after cutting and degree of forestry effort on the cutover area and elsewhere on the ownership were observed and used as the basis for classification. The entire area of each property with cutting was considered as operating area. Operating area within each type or size class of ownership was distributed over the five cutting practice levels in summarizing the results.
3. In 1947 the Forest Service and the Mississippi Agricultural Experiment Station jointly studied the ownership and management of private forest lands in central Mississippi. Technical Bulletin 23 of the Mississippi Agricultural Experiment Station contains the results. Forest management was rated on the basis of cutting practice and fire protection by six classes ranging from "excellent" to "destructive." Emphasis in the cutting practice phase was placed on the changes which cutting made in stocking and species composition. The level of management was related to size class and type of ownership both on the basis of acreage owned and number of owners.
4. The Northeast Pulpwood Research Center under auspices of the pulp industry studied cutting practices on private lands in New England, New York, and Pennsylvania in 1950–51 and published the *Forest Practice Survey Reports* in 1952. The five forest practice classifications used by the Forest Service a few years earlier were adapted with local modification in this study, but the method of relating the ratings to locality and type of ownership was based upon the volume removed under each practice level rather than area. This was the first of such studies to report the distribution of practice levels by forest types in addition to locality and ownership classification. Another innovation was the separation of results under intent of owners to practice forestry and results secured by accident.
5. Current cutting practices on both public and private forest lands in Michigan were studied in 1952 by Michigan State College and results published as Technical Bulletin 238 of that institution. Cuttings were classified into three grades and these were related to ownership group in proportion to the acreage held by each group. This study dealt with condition of forest stands before and after cutting and emphasized the effect of cutting on tree size and quality.
6. In 1953 the Tennessee Valley Authority conducted a study on the management of private lands in the Tennessee Valley. Man-

agement was classified into three groups, "Good to Excellent," "Fair," "Destructive to Poor." Qualification for one of these was based upon integration of nine rating elements. These were planning, volume cut control, silvicultural control, logging control, fire control, insect and disease control, grazing control, tree planting, and improvements. Relation to size class and type of ownership was based both on forest area and on number of owners. Results appeared in 1954 in a Tennessee Valley Authority publication *Private Forest Management in the Tennessee Valley*.

7. Also in 1953 the Southern Pulpwood Conservation Association began a sampling of pulpwood cuttings. These were confined to cutting by Association members on non-company lands and classified the type of cutting employed, i. e., clear-cut, land clearing, seed tree, partial cut, thinning, or salvage cutting. The volume of pulpwood removed under each type of cutting was used as the basis for weighting of summaries. This study is conducted annually.

Thus since 1942 seven related surveys have been conducted. The Federal Government, the States, and the pulpwood industry have been responsible for two each with another sponsored jointly by Federal and State sources. The survey of recently cut lands, conducted as part of the Timber Resource Review, is the eighth such effort in little more than a decade, but only the second on a national basis.

The brief summary of past related work shows wide variation in concepts. The basic elements recognized have ranged from the two used in the first such study by Louisiana State University to the nine element rating system of the Tennessee Valley Authority. Weighting of final results has included area, number of owners, and volume concepts. Standards for classifications have ranged from descriptive definitions to specific numerical measures or combinations of these two. Some have placed major dependence on what people were doing in their woodlands by classifying practices. Other standards were based primarily on conditions actually observed in the field. Combinations of these two are common. Field work has varied from quick classification of general conditions as observed by trained workers to specific counts or tallies on sample plots. Despite these differences a feature common to all such studies is concern as to the contribution that cutover areas will make to future timber supplies.

Obviously concepts and methods are far from standardized and are going through developmental stages. The subject covers a large number of complex biological and other technical relations. Newness of these efforts and only partial development of forest science in the United States is responsible for variations in concepts and methods. They are also responsible in part for the contention that frequently accompanies such efforts. Standards have changed during the few years of effort on such surveys and will continue to change as new knowledge and new problems develop. Comparisons between surveys conducted at intervals to determine trends will not prove valid during this rapid stage of development. Each survey stands on its own merits as an expression of the concepts under which it was conducted.

Comparability of National Surveys

With two national surveys completed, one in 1945 and the other in 1953–54, comparisons between them to observe trends are probably inevitable. However, some major concepts basic to the two surveys differ so widely that comparisons between results are not valid and meaningful estimates of trends cannot be made.

Early during the period of review and formulation of plans for this phase of the Timber Resource Review, the new concepts developed raised sharply the question of comparability with the forest practice survey of the Reappraisal Report. At this point the Forest Service had a choice of the following alternatives:

1. Adopt concepts substantially the same as those of the Reappraisal and thus preserve opportunity for comparisons.
2. Sacrifice comparability for survey results based upon new concepts and changes in previous ones judged important because of advances in technical knowledge and recent experience.

The decision was made to adopt the second of these alternatives thus sacrificing comparability.

Probably the least invalid of several possible methods for determining trends is to compare the proportion of recently cut lands in the upper productivity class of the current survey with the combined proportions of "high order," "good," and perhaps half of the "fair" practice levels of the Reappraisal. However, any statistics derived by this method will provide very questionable basis for comparisons of trends.

Major reasons for lack of comparability are: (a) differences in standards used to derive final classification of the land unit examined, (b) differences in concept of operating area which is used to derive final summaries of results, and (c) differences in the number of classification levels used to express results. There are additional minor differences which in total add considerably to the lack of comparability. In a following portion of this report which presents the basic concepts, these differences will be explained in more detail.

How Concepts Were Developed

The first step in developing plans for the survey of recently cut lands was a conference with a working committee of the national advisory group to consider the scope of this survey. Following this, a preliminary plan was developed by a Forest Service task group and released for review purposes in July of 1952. Comments and suggestions for revision of this preliminary plan were obtained as follows:

1. The plan was reviewed at local public meetings called by Regional Foresters of the Forest Service. Representatives were invited from industrial groups, the forest schools, labor, conservation associations, and from Federal and State conservation agencies.
2. Later these local meetings culminated in a series of four larger conferences held at Atlanta, Ga., Philadelphia, Pa., Milwaukee, Wis., and San Francisco, Calif. Here were summarized the results of the local meetings.
3. In addition, a number of more limited local meetings and numerous conferences were held to obtain advice and suggestions on the preliminary rating standards or criteria for each forest type. Foresters from public agencies and from industry participated in this phase.
4. The minutes of meetings, resolutions, and briefs filed by organized groups and other sources of comment were carefully analyzed as a basis for revision of preliminary plans and criteria.

The analysis of comments revealed many constructive suggestions and also showed that commentators were not in agreement on many important phases. Revision of the plan, including trial runs in the field, required nearly a year and a greatly revised plan was again released for review in July 1953.

After additional revisions, the Forest Service felt that a reasonable balance had been reached in meeting constructive suggestions and that further review would be of little value. It also felt that the concepts, standards, and procedures developed were reasonable and represented a step forward in dealing with the subject of recently cut lands which will continue to be of recurring concern.

CONCEPTS AND PROCEDURES

Summary

Four major elements present in varying degree on all recently cut areas were chosen as the basis for classification of productivity on recently cut lands. These four elements were those judged to exercise the greatest combined influence on current and prospective growth of timber in both quantity and quality. They are (a) existing stocking, (b) prospective stocking, (c) species composition, and (d) effect of felling age or premature cutting.

Quantitative standards were developed for each element based upon technical forestry information, but tempered by judgment as to practical attainability under current operating conditions and status of knowledge. Adaptability to the widely varying nature of our forests was provided by setting up separate standards for the important sites or localities within each forest type of every region.

The concept of practical attainability is highly important to interpretation of results and was chosen from a number of possible concepts. The other alternatives considered but discarded consist of standards aimed at (a) developing the maximum level of growth found in nature and expressed in normal yield tables, or other appropriate sources of technical information, (b) determining conformity to a classification of forest management practices, (c) meeting projected future demands for timber products.

The concept of maximum growth was considered impractical because limited knowledge or excessive costs prohibit consistent attainment of such levels in many forest types. Appraisal of recently cut areas by classification of forest management practices was discarded because the method requires adoption of questionable assumptions on the relation between future growth and various cutting practices, sustained yield, stand improvement, and other management measures. Standards geared to meeting projected demands for timber products would have required delaying the survey of recently cut lands until estimates of such demands had been made, thus nearly doubling the time required to complete the Timber Resource Review. In addition, the allocation to recently cut lands of an appropriate share of future needed growth could not have been accomplished without costly special studies to obtain details on growth not yet available in this country.

Judgment in developing standards was applied by comparing the condition of recently cut lands on ownerships following the better forest practices with conditions for growth expressed in normal yield tables or other technical sources. Ratios resulting from these comparisons were then used to develop standards. For example, if the stocking of recently cut areas on the better managed ownerships of a given forest type was 50 percent of the stocking associated with upper growth levels as shown in technical references, this ratio was used to determine the numbers of trees per acre of various sizes representing 100 percent stocking in the standards. The stocking standards adopted for trees of sawtimber size generally range from 50 percent to 70 percent of yield table values, depending upon forest type

and locality. Stocking standards for seedlings and for saplings represent much smaller percentages of the better stocked stands found in nature. Reasons for adopting these lower standards for seedling and sapling trees will be found in the subsequent discussion on Existing Stocking.

In application of standards, field measurements of each element on a recently cut area were calculated as a percentage or proportion of the appropriate standard. Such percentages were called factors or ratings. A method of calculation was adopted which integrated these factors into a single productivity index. The possible range of such indexes was 0 to 100. The standards for each locality were applied and productivity indexes computed for every area examined in the locality. Under this system, the standards might be low for some ownerships where operating conditions were more favorable than those prevailing in the locality, or they might be high for ownerships where operating conditions were more difficult. No adjustment of standards was made for individual ownerships. The assumption was made that, for a given class of ownerships, the area rated under standards too low for certain individual ownerships were balanced by other areas rated under standards too high for them.

The standards together with instructions for calculating factors and productivity indexes and for field procedures were incorporated in manuals for each region. These are summarized in the appendix section Criteria. Each field examiner was provided with a copy of the appropriate regional manual and trained in its use.

Because of limited facilities, the intensity of survey coverage was aimed at reliable statistics for each region only, but provision was made for adequate statewide data where local interest supplemented regional sampling to the extent necessary. The method of choosing ownerships for examination varied with size class. Sampling methods were used for the extremely large number of small private ownerships. For private ownerships of medium size, sampling was used in States where this size class was numerous, but the recent cutovers of all were examined in States with few such ownerships. With a single exception, the recently cut areas of all large private ownerships were examined in each State. Generally, this type of full coverage was also used for public lands. The public lands and large private ownerships were examined separately by working circles or blocks.

No area was examined that had been cut over prior to January 1, 1947. On an individual ownership, the most recent cutting made between that date and the time of examination was chosen for field measurement. This procedure was followed for the recently cut portions of each forest type on the ownership. Thus a factor or rating for each element and a combined productivity index was calculated for the recently cut portion of each forest type on every ownership examined. On many ownerships this procedure resulted in two or more indexes depending upon the number of types with recent cutting. In addition to this productivity data, field examiners also recorded for every ownership examined the area of each forest type in which recent cutting had occurred, the total commercial forest area, and other related information required by the plans.

Occasionally no recent cutting had taken place on an entire ownership or on one or more forest types of an ownership. These areas were considered as nonoperating. On each ownership with recent cutting only the total area of forest types in which cutting had occurred was classified as the operating area of the ownerships. About 48 percent of all commercial forest land was classified as operating area.

Compilation of results was begun by dividing the entire range of productivity indexes into 3 broad classes as follows:

Productivity index range:	*Equivalent productivity class*
0–39	Lower
40–69	Medium
70–100	Upper

The next step was to tabulate operating areas by productivity classes in accordance with the indexes previously calculated from field measurement. Finally, the total operating area in each productivity class was expressed as a percentage of all operating area. Tabulations of the three productivity classes are used to compare the relative condition of recently cut lands by ownership classes, regions, forest type groups, and other broad subdivisions of commercial forest land. Additional similar tabulations were prepared to show the relative effects of each element on the proportion of area in the various productivity classes.

Earlier discussion of concepts pointed out that standards for each element were based upon current practical attainability. A productivity index of 100 means that such standards were fully met for all four elements. Any result showing that 50 percent of the recently cut lands in a given region were found to be in the upper productivity class means that 50 percent of such lands met 70 to 100 percent of the standards practically attainable.

The preceding summary of concepts and procedures is amplified on the pages immediately following. Much of this amplification is necessarily technical and quite detailed. If the reader does not wish to go into further detail as to concepts and procedures, he should pass over this part of the report and turn to the discussion How High Are the Standards, page 236, or to the results. However, the fuller explanation will contribute significantly to better understanding of the results and is recommended.

The Elements Adopted

The most useful measure of productivity on any cutover area would be the current and future annual or periodic growth in terms of board-feet and cubic feet by species or species groups. Since reliable methods of forecasting growth directly on some cutovers and on the large scale required for national surveys are not available, less direct means were used. Therefore, certain elements or specific conditions of cutover areas, directly affecting growth, were chosen as a basis for appraising productivity.

The major elements considered most directly related to current and prospective growth on cutover areas and which could be measured on the ground were chosen for study. These elements were (a) existing stocking, (b) prospective stocking, (c) species composition, and (d) effect of felling age with relation to maturity. Concentration on these four elements left out of consideration other elements of forest management such as adherence to sustained-yield policies, existence of written forest management plans, and any silvicultural systems or methods found in effect. Thus the study does not appraise the status of management.

Adoption of these elements also omits any direct measure or recognition of the intent to practice forestry on any ownership or the degree of effort expended to create a given set of conditions on a cutover area. On the basis of the four elements, the end result of the cutting is subjected to measurement and appraisal whether it be accomplished by accident or by carefully designed effort. This differs basically from the Reappraisal Report concept which rated forest practices on a combination of standards for cutover areas and degree of forestry effort expended on the entire ownership.

Existing Stocking

Growth of forest stands varies with stocking, hence a measure of stocking on the ground is essential to appraisal of current and future productivity. In its simplest terms, stocking is expressed in numbers of trees per acre. For purposes of this survey, existing stocking consisted of trees on the ground immediately after cutting plus those which had become established between the time of cutting and the time of examination.

But not all trees on the ground are usable even if of merchantable size, because of defects or because they consist of noncommercial species. Thus, cull trees were eliminated from the stocking count as were trees of commercial species overtopped by larger cull trees. Trees with low vigor or other damage due to disease, insects, or animals were also eliminated from the stocking count by adoption of standards describing permissible limits of damage or by observation of the examiner where this indicated that such trees would not survive. Hence, a "crop tree" concept was adopted which limited the count of existing stocking to those trees of commercial species found currently or potentially productive. The crop tree concept was applied to trees of all sizes beginning with well-established seedlings.

For each forest type or subtype, and where deemed important by site or geographical area within a type, stocking standards were drawn up showing the number of crop trees per acre of each size class considered to constitute standard or 100 percent stocking. Field procedures were devised by which any distribution of tree sizes found on a recently cut area could be translated into a percentage of the standard stocking. Thus, the size of crop trees did not influence the stocking rating. The same rating derived from a given number of large trees could be attained by their equivalent consisting of a larger number of small trees.

In developing standards, the basic references used were normal yield tables and other technical sources of information showing averages of the higher levels of stocking found in natural, uncut stands. Such high levels of stocking are usually referred to as "normal" stocking, and this meaning of the term is used in subsequent discussion. Stocking standards were derived by reducing normal stocking to the averages found on recently cut areas of ownerships judged to be well managed.

For trees of sawtimber size, the standards for 100 percent stocking of recently cut lands represented from 50 percent to 70 percent of normal stocking, depending upon forest type and locality. However, 70 percent of the stocking standard was needed to qualify for the upper level of stocking. Thus, any recently cut area with 35 to 50 percent of normal stocking in trees of sawtimber size would qualify for the upper productivity level provided standards for other elements were met.

For seedling and sapling trees, the standards represented much lower percentages of normal stocking. For most forest types, standards for crop trees ranging from established seedlings to trees one inch in diameter were set at 1,000 per acre. For a few types, 500 to 750 established seedlings were accepted as 100 percent stocking. Stocking standards always required many more small trees than large ones. For example, on the Douglas-fir type of Oregon and Washington, 750 crop trees per acre less than 2 years of age and 58 trees per acre in the 24-inch diameter class both represented 100 percent stocking. Yet "normal" stocking of trees in very young stands of Douglas-fir exceeds 4,000 trees per acre.

Reasons for adopting standards so much lower than normal for small trees are based on a well-recognized tendency for young forest stands of varying stocking to reach or approach normal stocking as they grow older. Thus, young, understocked stands will tend to reach or approach normal stocking in later years. On the basis of

this trend alone still lower standards might have been adopted for small trees. However, other equally important factors indicate that stocking based only on trends of approach toward normality would lead to an inadequate appraisal of productivity. These factors are (a) the adverse effects of low initial stocking upon subsequent form and quality of the timber produced, (b) the limited opportunity for yields of timber prior to maturity by thinning and partial cutting where early stocking is based only on sufficient numbers of trees to provide a full crop at maturity.

These two factors indicate the need for greater initial stocking than would result from consideration of only the tendency toward normal stocking. Final stocking standards reflect a balance between all these factors affecting the subsequent productivity of young stands.

Prospective Stocking

Stocking is often in a state of rapid change for several years after cutting, particularly where conditions are favorable for establishment of new trees. Since field examination was made frequently within only a year or two after cutting, a fair appraisal of stocking requires consideration of the prospects for additional new trees. Prospects for stocking depend upon a number of factors such as the adequacy of seed sources, including their wind firmness and freedom from insects and disease, the natural seedbed conditions, the density of inhibiting vegetation such as cull trees, noncommercial species or brush, animal populations, topographic features, and others. These individual factors vary widely in importance between forest types, age classes, soil conditions, and localities. All available information regarding effects of such factors on establishment of new trees was summarized in standard tabulations and procedures for estimating the additional stocking expected from field measurement of the important factors. The inhibiting nature of some factors as well as the contributing or beneficial nature of others was recognized in these processes.

Plans for planting were also considered in situations where both existing and prospective stocking were poor. On such areas, stocking was adjusted to the level of past success in planting on the ownership if tangible evidence was available that planting would be done. The evidence required to qualify for such an adjusted rating consisted of outstanding orders, contracts, or similar commitments for planting.

Prospective stocking added to existing stocking provides a more valid estimate of the overall stocking condition than does existing stocking alone.

Species Composition

Many forest types in the United States contain large numbers of species. In most types, the commercial species vary in ability to grow, in usefulness, and hence in value. Some are of relatively limited use There is frequently a strong tendency, in harvesting forest products, to remove the species of greatest current value, leaving marginal species to occupy the ground in greater proportions than before cutting. Repetition of this process during several cuts on the same area results in deterioration of species composition. The degree of this change varies widely with forest types, economic situations, amount of forestry effort, and the time over which periodic cuttings have occurred.

During recent years, there has been a trend toward greater use of the less valuable species as a result of new products or uses but also in response to high prices and limited supplies of better species. But with few exceptions the species whose inherent technical properties have resulted in a preferential position for a long time are still the most useful and valuable in our economy.

Some of the marginal or less desirable commercial species grow wood as fast as some of the preferred species, or even faster. However, poor quality or technical properties of the wood limit the utility of such growth. A measure of such limitations was devised by first classifying the commercial species of each forest type or subtype into the two groups, "desirable species" and "acceptable species." Noncommercial species were not included in either group nor was any direct count of their numbers made at any stage of the rating procedure. However, their influence was reflected in the count of existing crop trees since competitive effects of noncommercial trees occasionally disqualified as a crop tree an otherwise desirable one. Also the presence of noncommercial species sometimes limited the area otherwise available for prospective stocking.

In the classification of commercial species referred to above, recognition was given to many local variations and modifications. Such variations appear in the voluminous footnotes accompanying the tabulations of species in the appendix section Criteria. They also have been taken into account in the general instructions appearing in sections of the Criteria dealing with species classification.

The second step in taking account of composition was establishment of a standard requirement that at least 50 percent of the stocking on a recently cut area consist of species classified in the "desirable" category. A procedure was devised for computing a composition factor that reduced the stocking percentage if composition was found to be less than 50 percent. Stocking percentage was unchanged if the composition standard was met.

Thus, on any recently cut area, if half or more of the stocking consisted of desirable species, the composition factor was 1.0. If less than half of the stocking consisted of desirable species, say 40 per-

cent, the composition factor was computed as follows: $\frac{40}{50}=.80$. In brief, the composition on this area was 80 percent of the standard.

Literal application of this procedure might, in some cases, result in a zero composition factor. This could lead to the unrealistic implication that the growth of a forest stand consisting of "acceptable" species only would have no utility whatever. Hence, a minimum composition factor of 0.5 was adopted. No composition factor lower than this minimum limit was applied.

Effect of Felling Age or Premature Cutting

Forest stands grow in natural cycles. These cycles or natural growth trends have been defined by study of the average annual growth of many species. First it is necessary to define average or mean annual growth. The term refers to the growth calculated by dividing the volume of a stand of timber by its age in years. Usually mean annual growth is expressed in units of volume per acre at a given age. By calculating the mean annual growth in stands of a given species or forest type for a series of ages, the changes of growth with advancing age can be determined. All past investigations of this kind have shown that from the age at which volume can be measured in usable products the mean annual growth increases rapidly with age, reaches a peak, and declines.

This basic growth cycle is illustrated in figure 78. Using it as an example, we see that the peak of mean annual growth is reached at 125 years. If clear cut, then the yield will represent the accumulation of annual growth amounting to an average of 100 volume units per year for 125 years, the maximum attainable. But if clear cut at 75 years an average annual growth of only 80 volume units or 80 percent of maximum would be realized. Partial cuttings such as thinnings or improvement cuttings made at ages younger than those of peak annual growth tend to maintain or increase subsequent growth of the stand and add to the total volume harvested during a complete growth cycle. Such partial cuttings therefore have beneficial effects upon productivity, while clear cutting at young ages reduces it.

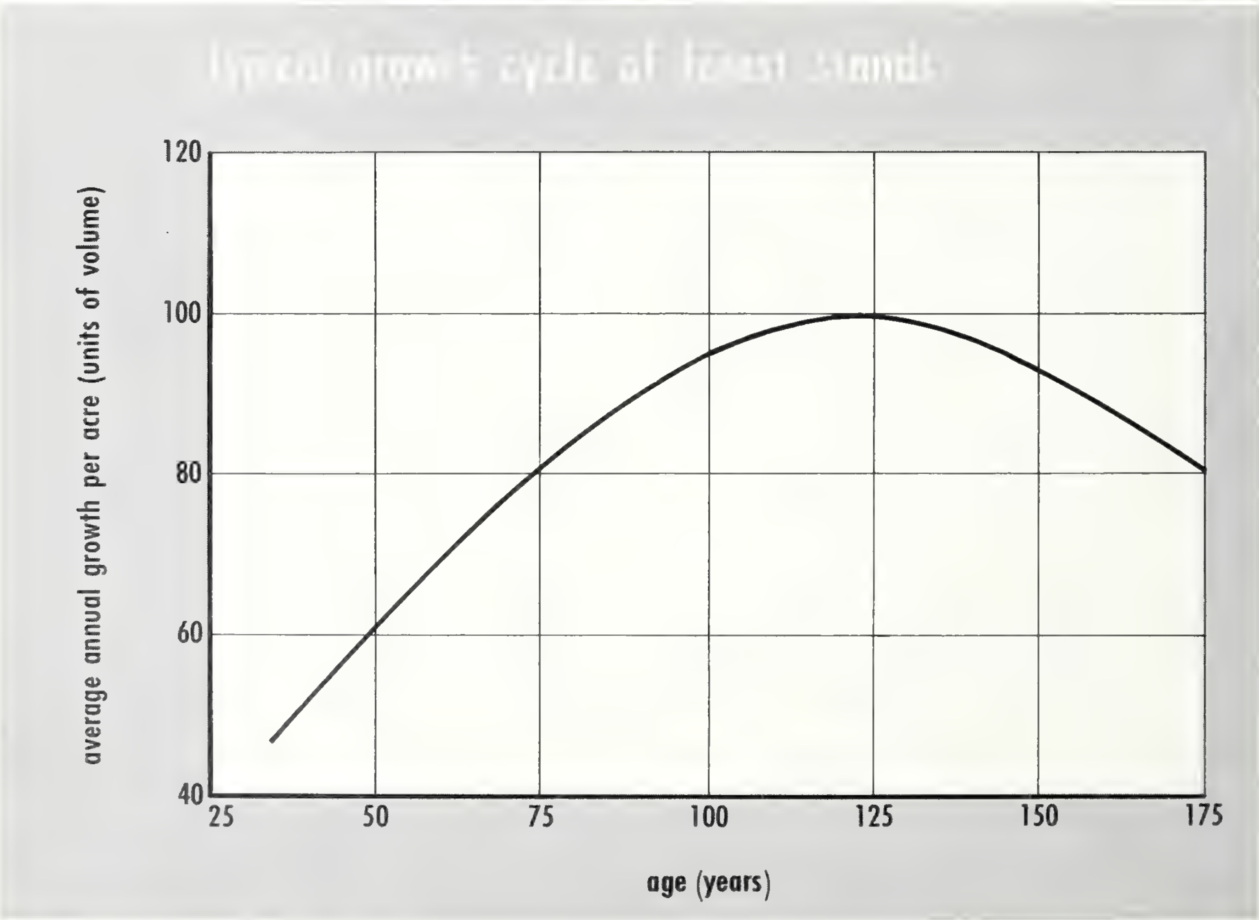


Figure 78

The general relationship shown in figure 78 has been found true for all species, but the rate at which average annual growth increases, the age at which the peak occurs, the period over which this peak is maintained and the rate of decline following the peak varies with species, growth potential of the soil, and other environmental factors. Likewise, the general relation holds whether the average annual growth is measured in board-feet, cubic feet, or cords. The main effect of different product measures is that peak growth is reached at younger ages when the product admits small trees. Hence the maximum growth is attained at younger ages for cordwood than for saw logs.

Because of this growth cycle, clear cutting prior to the age at which peak growth is attained reduces the mean annual growth realized as well as the total yield recovered. Conversely, if clear cut after the peak, the yield recovered is somewhat less, but for most species the value recovered is higher because of the greater proportion of high-quality wood in older trees than in younger ones. However, the relation of age to the volume and volume growth of different quality levels or grades of wood has been insufficiently studied in the United States. Therefore, specific information is unavailable for development of standards including consideration of the growth of quality wood.

Appraisal of felling age effects upon financial returns is another concept not yet implemented with basic information to the extent necessary for widespread application. Therefore, felling age was used in this survey to appraise its effects upon growth of wood volume only.

The discussion of figure 22 has shown how the clear cutting of timber at ages younger than those of peak growth reduces the yield and the growth attained. Such cutting has been termed "premature cutting." If such cutting becomes prevalent in a county, a State, or an ownership class, the average annual yields of timber harvested therefrom are materially lower than if young stands were thinned or partially cut and clear cut only at age of peak growth. The growth attainable by any degree of stocking and composition is likewise reduced by premature cutting.

Through use of the specific growth cycle relationships illustrated by example in figure 78 and established for many of our species, factors were derived showing the portion of attainable growth realized by clear cutting at given ages. These factors expressed as decimals of attainable growth were applied to the stocking rating as modified by composition to arrive at a final productivity rating.

This concept of applying a felling age factor assumes that the prevalence and degree of premature cutting will remain the same in the future as at present. Any interpretation of results should recognize that the results of the survey will change to the extent that effects of premature cutting may be more severe or less so in future years.

In devising standards for evaluating effects of premature cutting, all available information on growth cycles was used. Fortunately, some information has been accumulated for most of the major species or types. Where not available, the judgment of experienced foresters was called upon to devise standards. In a few cases, this resulted in the substitution of tree diameter for age as a standard for judging felling-age effects.

Standards were set up for each species or for species groups by site or geographic area within a forest type showing the percentage of the peak growth attained at various ages. These percentages express the effects of felling age. In the example presented by figure 78, the felling-age factor for a stand cut at 75 years would be 0.80. Thus these factors estimate the proportion of the attainable growth realized by cutting at given ages. In field application, the ages of stands clear cut were determined by annual ring counts on stumps and the appropriate felling-age factor found by reference to the Criteria.

Modifications of this general concept were necessary in application, and these are summarized below:

1. Felling-age factors were applied only to recently cut lands which were clear cut or to the clear-cut portions of such lands. For purposes of this survey, a clear cutting was defined as one which removed 80 percent or more of the trees that were merchantable for the products harvested and which resulted in removal of substantially all of the overstory present before cutting.
2. A number of situations were recognized where determination of felling-age effects was not appropriate. These occur where stand conditions indicate that the future volume growth will be low compared to that resulting from clear cutting and starting a new stand. Examples of this are young stands badly damaged by fire or forest pests; overmature timber beyond the age of peak growth and where growth will continue to decline; young stands where initial low stocking resulted in limby trees of such poor quality as to create doubt regarding the usefulness of any additional growth.

   There are also a few wood products based on such strict or specialized standards that volume of wood involved is a minor consideration. Examples are Christmas trees, poles, piling. Here the greatest usefulness of such trees is reached at a stage in development when they comply with product standards. Effect of felling age was not determined for the relatively limited amount of clear cutting for these products.
3. The effect of felling age was appraised for the general size class of product removed. Thus

where small trees were cut for cordwood products, the effect of felling age was based upon the age of peak growth measured in terms of cords or cubic feet. Where sawlogs were removed, the effect of felling age was based upon the age when growth is at a maximum in terms of board-feet. Hence the procedure included neither direct nor indirect judgment as to the desirability of either present or future requirements for different products. A free choice of products objectives was assured.

The standards by product size classes are included in the appendix section Criteria, together with the local modifications provided for and examples of detailed methods and calculations for application of felling-age factors in both even-aged and many-aged stands.

Basic Level of Standards

The standards of measurement chosen for each of the four elements represent what was judged to be the most productive condition currently attainable under prevailing operating conditions and the status of knowledge available for each forest type and region or subregion. Thus the standards represent conditions practically attainable. They are not related to any specified portion of the growth obtainable by full application of all known technology. Standards developed on the basis adopted are likely to be high in comparison to those practical of attainment a decade or more ago. They will likely prove to be low in the future as economic situations and technological advances favor the development of forestry. Considerable emphasis in developing standards therefore was placed on the exercise of judgment as to the desirable condition of recently cut areas that was currently practical of attainment. The ways in which judgment was applied in arriving at standards under this concept is previously described under the subtitle How Concepts Were Developed.

The Productivity Index and Class

The four elements used in appraising the productivity of recently cut lands were integrated into a single productivity index. The entire possible range of indexes, 0–100, were subdivided into three broad productivity classes, upper, medium, and lower, as presented in the summary, page 71. The index calculated for each area examined was assigned to the appropriate productivity class.

Methods of Calculating Productivity Index.—The following discussion will explain the methods used in calculating the productivity index and the reasoning basic to the methods.

The first two elements closely related to growth, i. e., existing stocking and prospective stocking, together obviously constitute the total stocking which will provide the next cut of forest products. The first step in deriving the index was simply addition of the stocking percentages for existing and prospective stocking. The result is a rating of total stocking expressed as a percentage of the standard chosen to represent 100 percent stocking.

The previous discussion on species composition has shown how poor composition reduces the utility and value of the current and expected growth. A composition standard was presented. Also, for situations where field examination showed that the standard was not met, a method was presented for calculating a composition factor. This factor appraises the limitation placed upon the utility and value of the growth due to substandard composition. It is expressed as a proportion of growth attainable by a standard composition for the total stocking found. Thus the factor for standard composition is 1.0, but for substandard compositions is 0.95, 0.90, 0.85, or some other decimal not lower than 0.5. Expressed in this way, as a proportion, the mathematical relation of total stocking to composition is one of multiplication. As an example, assume a total stocking of 80 percent and a composition factor of 0.9. The second step in deriving a final productivity index then is the calculation $80\times0.9=72$. The result, 72, is the rating for total stocking modified by composition.

The effects of felling age or premature cutting in limiting growth on clear-cut areas have also been described. The growth cycle shown in figure 78 has been used to illustrate how the effects on mean annual growth of cutting at a given age can be expressed as a proportion of the growth attainable at the age of peak growth. The relation between total stocking modified by composition and the final element of felling age is again one of multiplication. In the event that a felling age proportion or factor of 0.80 was found applicable to the example used in the discussion of composition, the calculation would be $72\times0.8=58$, the final productivity rating.

In aggregating areas for final results, the influence of the factor for premature cutting is to reduce the area of a given stocking and composition rating by the area on which the crop chosen for production did not reach the age of maximum growth.

More detailed examples and sample calculations are included in the Criteria portion of the appendix. Here also will be found the variations in procedures and standards which were adopted in various sections of the country.

Standards Geared to Local Situations

Forest types differ widely in natural characteristics such as their ability to reproduce after cutting, in species composition, in inherent capacity to produce wood. Within each forest type, variations in soil, climate, and other factors affect productive capacity. For practical use, these variations are recognized by site classifications, physiographic units, or localities. Timber cutting is conducted over the entire range of these natural conditions and the productivity of recently cut lands must be appraised against standards appropriate for the natural conditions. Only in this way can the effects of cutting be appraised separately from the effects of natural factors.

The first step in meeting this need for flexibility was local determination of the forest types to be recognized in each region. However, in final reporting of results, each of these was keyed as a subtype to one of the 20 major type groups adopted by the Forest Survey (appendix section definitions). For each regional type, standards for determination of existing and prospective stocking, effects of felling age, and species composition were prepared by site classes, physiographic units, or localities. In a few cases, broad soil classes or other factors were recognized (appendix section Criteria). Thus, in field examination of recently cut land on a single ownership, several sets of standards might be applied to conform with changes in forest type or other natural conditions.

Only Recent Cuttings Examined

Only cuttings made between January 1, 1947, and the time of examination in 1953 or 1954 were subject to examination. This choice of a specific recent period provides for a better expression of current conditions on such lands than if all areas where cutting had been done were examined without regard to the time of cutting. This is particularly important at a time when forestry appears to be advancing as rapidly as in the past decade.

Within this time period, the general rule was adopted to appraise on each ownership examined the most recent cutting made since January 1, 1947. Some modifications to this rule were adopted for specific types in a few regions and are explained in appendix section Criteria for Rating Productivity.

Degree of Survey Coverage

The general framework of field coverage involved sampling surveys among the numerous small ownerships, either sampling or full canvass among owners of medium-sized holdings depending upon their numbers in each State, and full coverage of public lands and large private ownerships. Field examination on individual recently cut areas consisted of specific counts or measurements on sample plots or at examination points distributed throughout each unit of land examined. The intensity of sampling used on each recently cut unit was based on general guides derived from preliminary trials conducted in a variety of forest types and on recently cut areas of various sizes.

Because of limited time and facilities relative to the size of the job, reliability standards were aimed at providing for comparisons between regions, or between ownership classes, forest type groups, or similar classifications on a broad basis. Sampling errors achieved are presented in the appendix section Adequacy of Data. Sampling to provide sound figures on a State basis was accomplished only where State agencies or private sources supplemented the basic survey sufficiently. For the few States where this was done, the Forest Service agreed to provide the results separately to collaborating groups. However, no results for individual States are presented in this report.

Sampling Method

Recently cut lands of the numerous small private ownerships were sampled by two methods: (a) Examination of all ownerships in 2,500-acre sampling areas located within randomly chosen counties in each State of each region, (b) compilation of lists of small ownerships in each State of a region and random selection of ownerships from such lists. The first of these methods was used primarily in the East and the second in the West. Medium-sized private ownerships were sampled in States with 15 or more such ownerships, but all of them were examined in States with less than 15 ownerships of this size class. All large private ownerships were examined except in Florida, where their number justified sampling procedures. All Federal ownerships in a State were examined, including those of less than 5,000 acres. State, county, municipal, and other local public forests of 5,000 acres or more were also covered by complete canvass. Public ownerships, other than Federal, of less than 5,000 acres were covered by sampling either on the list or area basis previously outlined for small private ownerships.

For public ownerships organized on a working circle basis, each such working circle was viewed as a separate holding for individual examination and reporting. Where public lands were not so organized, each separate unit or block of land recognized by the responsible administrative agency was considered to be a separate recording unit and the recently cut lands in each examined and rated. This same procedure was applied to large private ownerships.

Access was denied to the recently cut lands of six large ownerships comprising a total of 1.5 million acres. The areas of these six ownerships are included in statistics of total commercial forest area by various size classes and types of ownership. The operating area of these ownerships and the productivity of recently cut lands on them was not ascertained and are therefore not included in any statistics of operating area or productivity.

Ownership Classification

All preceding related surveys have shown the importance of ownership. Hence a basic consideration prior to field examination was the classification of forest ownerships. For purposes of this survey, each ownership was classified both as to size class of commercial forest land and type of ownership. The classifications used are as follows:

Size classification for private ownerships

Class 1, 50,000 acres or more, Large owners
Class 2, 5,000–50,000 acres, Medium owners
Class 3, under 5,000 acres, Small owners
Class 3a, 500–5,000 acres
Class 3b, 100–500 acres
Class 3c, less than 100 acres

Minimum size limits adopted for Class 3c were 3 acres in the East and 10 acres in the West.

Classification by type of owner, all ownerships

Private forest lands	*Public forest lands*
1. Farm	1. National forest
2. Lumber manufacturer	2. Bureau of Land Management
3. Pulp manufacturer	3. Indian
4. Other wood manufacturers	4. Other Federal
5. Other private	5. State, county, municipal

The term "forest industry ownerships" as used in subsequent discussions refers to the combined ownership of lumber manufacturers, pulp manufacturers, and other wood manufacturers.

Method of Expressing Results

With a productivity class determined for the recently cut portion of each forest type on every ownership examined, a number of alternatives are available for expressing final results. The earlier discussion of previous related appraisals has shown that volume, several measures of area, and numbers of owners have all been used to weight or average the findings. Careful study was devoted to a number of alternatives. The results showed that some methods emphasize the "upper" aspects, some the "lower." Such extremes are inherent in these methods. The one finally adopted gives results falling between the extremes shown by others.

Briefly, the method adopted consists of the following steps:

1. Determination, for every ownership examined, of the area of each forest type in which cutting had been done since January 1, 1947. Each area was considered to be a unit of "operating area." The sum of such units for a single ownership was defined as the "operating area" of the ownership. The sum of the "operating areas" for all the ownerships in a given size class is thus the "operating area" within that ownership size class.
2. Assignment of each unit of operating area to the productivity class within which it falls for the particular tabulation desired, whether it be ownership class, region, or a combination of these two.
3. Calculation of the percentage of all operating area in each productivity class.

This process can be illustrated by assuming that a forest ownership of 600 acres contained three forest types of 200 acres each with a part of each of two types cut since January 1, 1947. Here the operating area is confined to the two types with cutting. The operating areas for the ownership is thus 400 acres. Assume further that the recently cut portion of one type was found to be in the upper productivity class, while the recently cut portion of the second type was found to be in the lower productivity class. In this example, the 600-acre ownership would contribute 200 acres of operating area to the upper productivity class of final tabulations and also 200 acres to the lower productivity class. Note that average ratings for individual ownerships were not used. Had they been used, the entire operating area of 400 acres would probably have been assigned to the medium productivity class. Thus the final results provide an expression of the range in productivity class over the operating area. Under concepts of the Reappraisal, the entire 600 acres of the ownership would have been assigned to a single class.

The Survey on an Individual Ownership

The major steps in field procedure are summarized by using a hypothetical small ownership as an example. Figure 79 is a map of such an area. It is part of a sample that comprises a given percentage of the land area being sampled. The areas

determined by survey of this ownership and all other sample ownerships are multiplied by a factor or "sample multiplier." This multiplier is 100 divided by the percent of total land area in the samples.

The forest land on this property consists of 120 acres. The oak-pine type covers 50 acres and no cutting has taken place in this type since January 1, 1947. The remaining 70 acres is pine type, a part of which was cut since that time.

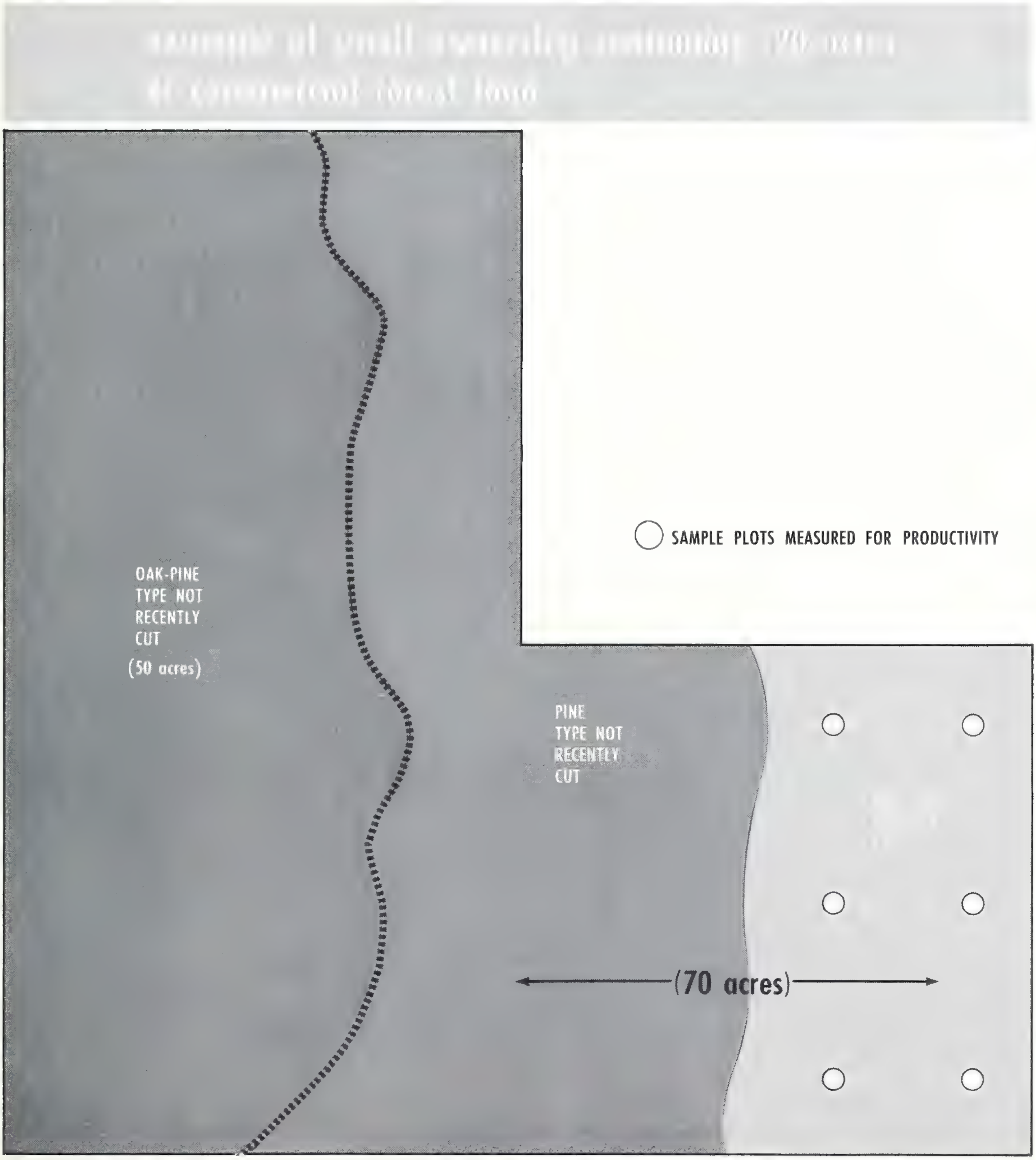


Figure 79

This basic information was obtained by field examiners from a variety of sources such as an interview with the owner, county records of various agencies, interviews with neighbors, local foresters, and by consulting aerial photographs. These photographs were a major source of information particularly for estimates of the area in each forest type on an ownership.

With the general location of the recently cut area ascertained, the field examiner made a reconnaissance to determine roughly its area and shape and a route of travel was determined that would represent all conditions. By reference to guides in a regional field manual, the number of one-fifth acre sample plots to be measured in the East or the number of sample points from which measurements were taken in the West and the distance between plots or points appropriate for an area of the approximate size to be examined were determined. Each plot or point was then located on the ground, measurements taken, and computations completed to arrive at the percentage of existing stocking, total stocking (existing plus prospective), stocking modified by composition if required, and the latter modified by effect of felling age if required. The last computation resulted in the productivity index.

Thus in the example shown by figure 79, there were six sample plots which provided six separate ratings of existing stocking. These were averaged to get a rating of existing stocking for the tract. Average ratings for each of the other three elements were derived similarly from the appropriate records for these six plots. All average ratings were recorded on a standard form for the pine type on the particular ownership together with identifying information and other observations made on the property to meet objectives of the survey. Had there also been recent cutting in the oak-pine type, a separate examination of this cutover area would also have been made. Data similar to those described for the pine type would have been recorded separately for the oak-pine type.

Essentially the same system was used throughout the country. Methods in the East and West varied in that sample plots were used universally in the East but the sample or observation "point" was adopted for western conditions. Both the sample plot and sample point systems are described in the appendix section Criteria for Rating Productivity.

How the Survey Results Were Summarized

The method, in broad outline, of how the ratings from this example would become part of final results is of interest. Assume that the final average productivity index calculated from the six plots shown in figure 79 was 58. Reference to the classification of indexes shows that this rating would be included in the medium productivity class. Since there were 70 acres of pine type, part of which was cut, and no cutting in the oak-pine type, the operating area of this property was recorded as 70 acres and the productivity level as medium.

To follow the summarizing of this final observation, refer to table 136, page 238. This table shows that for the country as a whole 32 million acres in ownerships of 100 to 500 acres were recorded as operating. The ownership used as an example contributed to this 32 million acres. Note further from table 1 that 36 percent of the operating area in the 100–500 acre ownership class was found to be in the medium class of productivity. This percentage was derived from a tabulation of results showing that there were 11.5 million acres of operating area in the medium class. This area represented 36 percent of the 32 million acre operating area in the 100–500 acre ownership class. The example of figure 79 contributed to the total of 11.5 million acres in the medium class.

How High Are the Standards?

In devising standards around the basic premise that they should reflect conditions attainable under current operating conditions, judgment is necessarily used to interpret the technical forestry information at hand. The varying opinions brought out during the process of applying judgment to meet the basic premise are the source of conflicting views on standards.

Some feel that the standards are too high and therefore will emphasize pessimistic aspects. Others have expressed the opinion that standards are too low. A number of considerations could have been included in the basic premises and procedural concepts that would have led to stricter standards. The more important of these are discussed as enumerated below:

1. Standards could have been built up on the basis of trends toward more intensive forestry. Standards developed on this basis would be higher than those adopted. However, it was felt that standards related only to judgments of current and reasonable attainability under average operating conditions would be of more practical value.
2. Procedures for measuring effect of felling age made no specific provision for growth of high-quality sawtimber. For many species, the age of maximum mean annual growth in board-foot volume occurs before appreciable

volumes of high-quality wood are produced. An additional period of years could have been added arbitrarily to felling age standards to make some allowance for quality growth. Productivity indexes thus would have been lower, particularly in the East where premature cutting is much more prevalent than in the West. However, this was not done because of lack of any specific guide lines for such arbitrary adjustment.

3. Effect of felling age was judged on basis of size class of product cut. On the grounds of a greater relative national need for large size than small size products, effect of felling age could have been appraised against the ages at which growth of sawtimber reaches a maximum. This, too, would have resulted in lower indexes, again primarily in the East. However, because both large and small products are needed in the U. S. economy, and because no basis existed for allocating proportions of small vs. large products objectives to a specific area of land, final decision was to appraise effect of felling age on productivity for the size class of products cut.
4. The standard for composition could have been based upon a higher proportion of desirable species than the 50 percent chosen. Some reviewers recommended a standard higher than this.
5. Standards both for existing and prospective stocking were frequently exceeded on ownerships operated under effective forestry policies. Whether stocking standards are too high or too low was vigorously debated during planning stages. Because these standards were occasionally exceeded during the survey—frequently on properties under forest management—actual experience during the survey lends little support to the idea that standards are too high as an expression of the stocking reasonably attainable under current operating conditions.
6. The use of only 3 broad classes to express results of the survey tends to obscure important relations between productivity of recently cut lands and such important factors as size class and type of ownership, geographic location, forest type group and others. The use of a greater number of classes would have provided the basis for more precise and informative comparisons.

MAJOR NATIONAL CONTRASTS

The tables and charts which provide background for the discussion and analysis of results in the following pages are summaries of more detailed statistics found in the appendix section Basic Statistics. Of these statistics, tables 22 and 23 on forest ownership and tables 70–77 on productivity of recently cut lands are the major references. These basic tables were developed in considerable detail so that others might derive summaries of particular interest to them. In some tables, the detail exceeds that contemplated by the sampling standards so that sampling errors are high. Readers consulting the appendix tables or making separate summaries from them can determine the statistical reliability of estimates by application of procedures outlined in the appendix section Adequacy of Data.

Public and Private Lands Compared

Nationally, 56 percent of the recently cut lands in private ownerships were found to have reached from 70 to 100 percent of the standards attainable under current operating conditions; that is, a little more than half of such lands were found to qualify for the upper productivity class. In contrast, 80 percent of the recently cut lands in public ownership were found to be in the upper productivity class (table 136).

The importance of this contrast is apparent from the proportion of total commercial forest area in each of these two ownership categories. Table 136 shows that 358 million acres or 73 percent of all commercial forest land is privately owned. The remaining 27 percent is in various types of Federal, State, and local public ownership.

Increases in the national level of growth needed to meet the wood requirements of our growing population and expanding economy must come, for the most part, from the large area of private lands. The condition of recently cut private lands falls considerably short of meeting standards attainable under current operating conditions. Because of this and the large area involved, the possibilities of raising the national growth level are much greater on private than on public lands.

Small Private Holdings a Major Problem

Productivity of recently cut areas on private lands is directly related to the size class of ownership—the smaller the ownership, the lower the

TABLE 136.—*Productivity of recently cut forest land [1] in the United States and Coastal Alaska, by size class and type of ownership, 1953*

PRIVATE HOLDINGS BY SIZE CLASS

Size class [2] and type of ownership	Commercial forest area		Proportion of operating area by productivity class		
	Total	Operating [3]	Upper	Medium	Lower
	Million acres	*Million acres*	*Percent*	*Percent*	*Percent*
3–100 acres	121	24	38	37	25
100–500	98	32	40	36	24
500–5,000	46	18	44	35	21
5,000–50,000	35	23	64	26	10
50,000 and larger	58	42	78	18	4
Total or average	358	139	56	29	15
HOLDINGS BY TYPE OF OWNERSHIP					
Private:					
Farm	165	53	41	37	22
Lumber manufacturing	35	24	73	21	6
Pulp manufacturing	23	17	84	15	1
Other wood manufacturing	4	3	73	23	4
Other private	131	42	52	28	20
Total or average	358	139	56	29	15
Public:					
National forest	85	66	81	16	3
Bureau of Land Management	7	5	80	15	5
Indian	7	5	74	25	1
Other Federal	5	2	80	16	4
State	19	13	77	18	5
County and local	8	5	76	24	(4)
Total or average	131	96	80	17	3
Total, all ownerships	489	235	65	24	11

[1] During period January 1, 1947, to date of examination in 1953 or 1954.

[2] Based on the total commercial forest area in the ownership.

[3] The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Excludes operating area on some large private ownerships on which access was denied.

[4] Less than 0.5 percent.

proportion of recently cut land in the upper productivity class. On ownerships of 100 acres or less, which include one-third of all private commercial forest land in the Nation, only 38 percent of recently cut lands fell in the upper productivity class. All small ownerships combined (less than 5,000 acres) comprise 74 percent of all private forest land and over half of all private and public combined. In this group, only 40 percent of recently cut lands qualify for the upper productivity class (fig. 80).

The situation is much more favorable on the larger private ownerships. For those of the medium size class (5,000–50,000 acres), 64 percent of the recently cut lands qualified in the upper productivity class. For large ownerships (50,000 acres and larger), 78 percent of recently cut lands were found to be in this upper productivity class.

The ownerships of medium and large size together contain 93 million acres or 26 percent of the private forest land and 19 percent of all commercial forest area.

Thus, small private ownerships comprise three-fourths of all private land and the productivity of recently cut areas on this large area was found to be much lower than that of the larger ownerships. This is the major reason why productivity of recently cut areas is lower for all private land than for public ownership.

Public and Forest Industry Lands Rank Highest

Results of the survey showed that type of ownership is also very important. Lands owned by pulp-manufacturing industries have the greatest proportion—84 percent—of recently cut lands in the upper productivity class, followed closely by national forests, other public, and lumber industry and other forest industry, with the latter two showing almost identical situations (fig. 81). Although substantial improvement can still be made, these types of ownership—public and forest industries—form a group where condition of recently cut areas is more favorable for current and future growth than is the case for other types of ownership. While there are variations within the group, the differences are not large and they all appear to be at about the same general level of productivity.

The combined ownership of the forest industries amounts to slightly under 13 percent of all commercial forest land, and the public lands comprise about 27 percent. Together these types of ownership, which are characterized by high proportions of recently cut lands in the upper productivity class, make up only 39 percent of all commercial forest land.

In contrast to the forest industry and public forest lands, only 41 percent of the recently cut lands on farm ownerships was found to be in the upper productivity class. On "other" private lands, the comparable figure is 52 percent.

For both farm and "other" private ownerships, the primary interest of land ownership is generally something other than production of forest products. Farm owners, of course, are usually most concerned with production of other farm crops, with timber as a secondary interest at best. "Other" private ownerships represent a wide variety of interests. Although some land is held primarily for timber values, generally the interest in forest products is secondary to mineral, power, recreation, wildlife, or other values. Included in the other private lands are both individual and corporate holdings, but mostly they are small ownerships as shown in table 137.

Table 137.—*Productivity of recently cut private lands* [1] *in continental United States, by type of owner and size class, 1953*

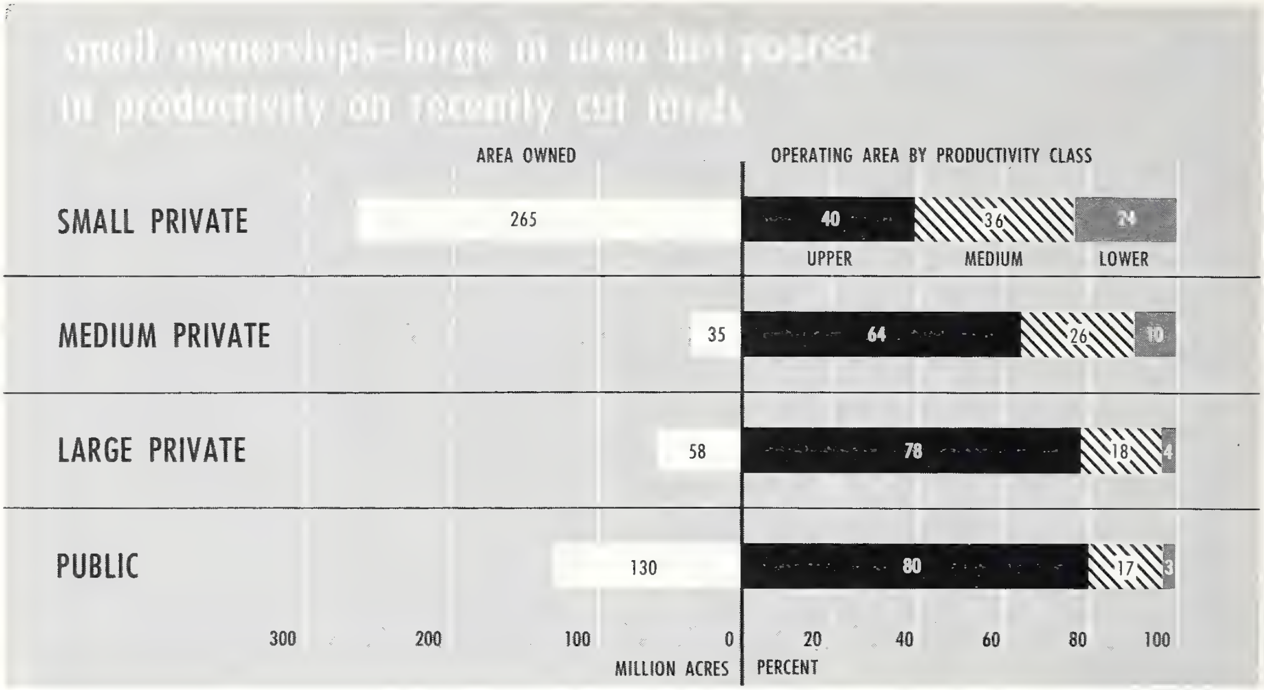
Type of owner and size class [2]	Commercial forest area		Proportion of operating area by productivity class		
	Total	Operating [3]	Upper	Medium	Lower
	Million acres	*Million acres*	*Percent*	*Percent*	*Percent*
Farm:					
Small	160	51	40	38	22
Medium and large	5	2	59	27	14
Lumber manufacturing:					
Small	5	3	48	35	17
Medium	11	8	74	20	6
Large	19	13	78	19	3
Pulp manufacturing:					
Small and medium	1	1	74	17	9
Large	22	16	84	15	1
Other wood manufacturing:					
Small and medium	3	2	72	25	3
Large	1	1	74	18	8
Other private:					
Small	100	20	41	31	28
Medium	16	10	56	31	13
Large	15	12	69	21	10
Total or average	358	139	56	29	15

[1] During period January 1, 1947, to date of examination in 1953 or 1954.

[2] Size class based on the total commercial forest area in the ownership. Small, 3–5,000 acres in the East, 10–5,000 acres in the West. Medium, 5,000–50,000 acres. Large, 50,000 acres or larger. Excludes 19,000 acres of private forest land in Coastal Alaska.

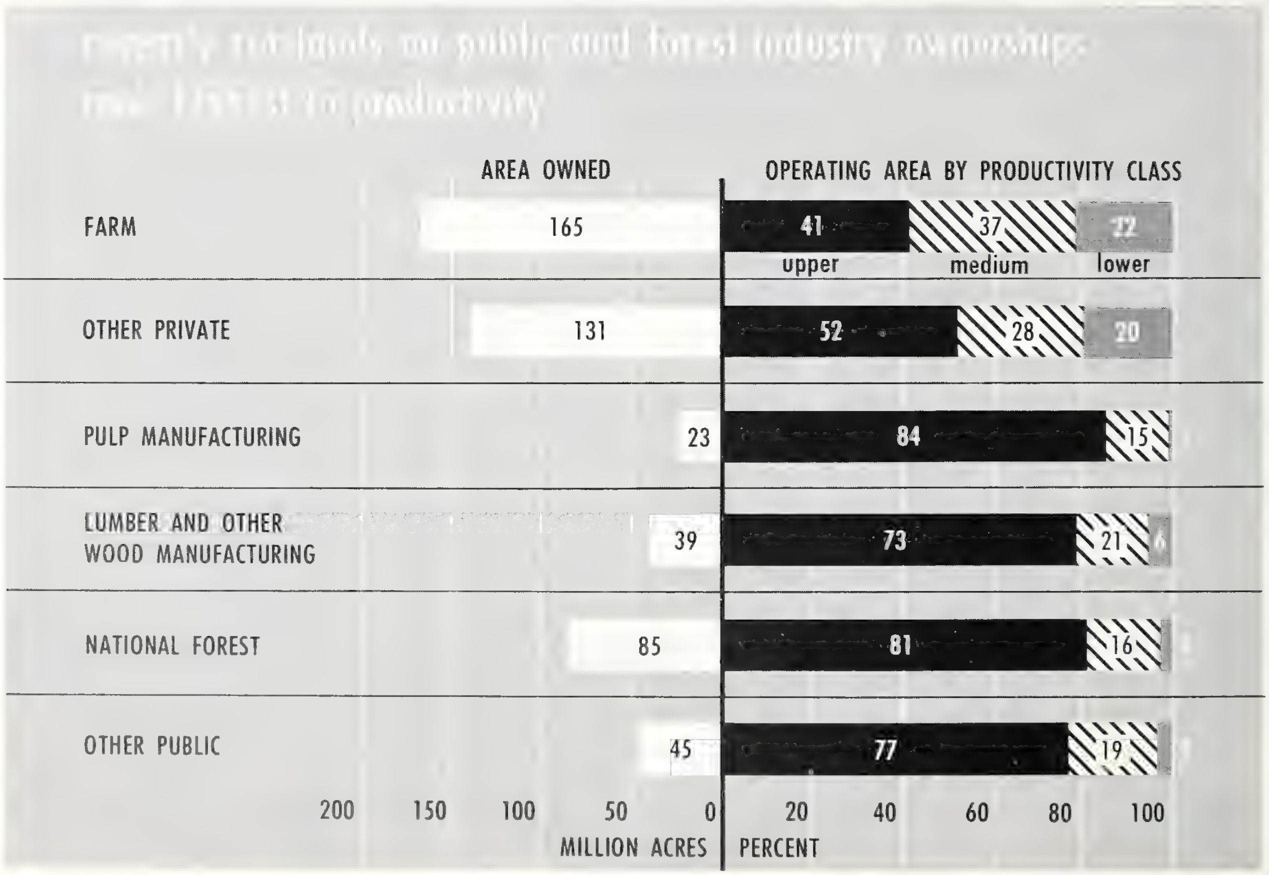
[3] The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some recent cutting was done. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Excludes operating area on some large private ownerships to which access was denied.

Thirty-four percent of all commercial forest land is on farms, and another 27 percent is on other private lands. This makes a total of 61 percent of all commercial forest area controlled by these



includes Coastal Alaska

Figure 80



includes Coastal Alaska

Figure 81

two types of ownership, with less than half of recently cut lands in the upper productivity class. This situation presents a serious threat to the Nation's capacity to meet future timber needs. It explains in part why farm timberlands with 34 percent of all commercial forest area contain only 15 percent of the sawtimber (Ownership of Forest Land and Timber, p. 309).

Productivity Lowest for Small Holdings in All Types of Private Ownership

The pulp-manufacturing industry is the only type of private forest land ownership characterized almost entirely by large holdings. Over half of the lumber-industry holdings are also large, but substantial portions are in the medium and small size classes. Other types of private ownership are primarily in the small size class (table 137).

Within each type of private ownership, the small size class (less than 5,000 acres) is characterized by the lowest proportions of recently cut lands in the upper productivity class. Thus the proportion of small holdings has a strong influence on the condition of recently cut lands in each type of ownership. The influence of the high proportion of small holdings is particularly apparent in table 137 for the farm and "other" private ownership classes.

In table 138 is shown the proportion of operating area in each type of ownership and its distribution by productivity class. Eleven percent of the operating area falls in the lower class, and most of

TABLE 138.—*Distribution of all operating area in the United States and Coastal Alaska, by type of ownership and productivity class, 1953*

Ownership class	Proportion of operating area by productivity class			
	Total	Upper	Medium	Lower
	Percent	*Percent*	*Percent*	*Percent*
Private:				
Farm	22	9	8	5
Forest industries	20	15	4	1
Other private	18	9	5	4
Total	60	33	17	10
Public:				
National forest	27	22	4	1
Other Federal	5	4	1	(1)
State and local	8	6	2	(1)
Total	40	32	7	1
Total, all ownerships	100	65	24	11

1 Less than 0.5 percent.

this—9 percent—occurs on farm and "other" private lands. Conversely, of the 65 percent in the upper class, only 18 percent (a little over one-fourth of the total) is on farm and other private lands.

Motives for Forest Land Ownership Not Determined

This survey did not inquire into motives for forest land ownership, the degree of forestry knowledge available, nor the many other factors that may have influenced the treatment of the forest lands examined. It was limited strictly to an appraisal of the conditions that exist on recently cut areas.

In the case of public forest lands, the responsibility placed on the agencies for their management as forest properties is probably the basic reason for the favorable growth conditions on most recently cut areas. The direct dependence of forest industries upon timber for raw material is reflected in the increasing adoption of policies and practices designed to keep these lands productive. The growing practice of employing professional foresters and placing on them the responsibility for forest management is commencing to show results on the land.

The contrasting poorer condition on farm and other private forest lands may be due to the competition of other activities, which subordinates interest in forest production. Lack of forestry knowledge and information on how to obtain it may also contribute to this condition. But the situations and factors responsible for the generally lower level of productivity on these types of ownership, as well as the small ownerships of all types, are not fully known.

PRODUCTIVITY OF RECENTLY CUT LANDS VARIES BY SECTION, REGION, OWNERSHIP CLASS, AND OTHER FACTORS

Productivity of recently cut lands was found to differ widely from one part of the country to another (fig. 82). Examination of these differences helps to identify the relative contribution to the national level of growth made by various combinations of ownership and geographic location. This will be done by major sections—North, South, and West. Within each section there are notable exceptions to the general average and these exceptions will be pointed out in later discussion of differences by both region and type of ownership.

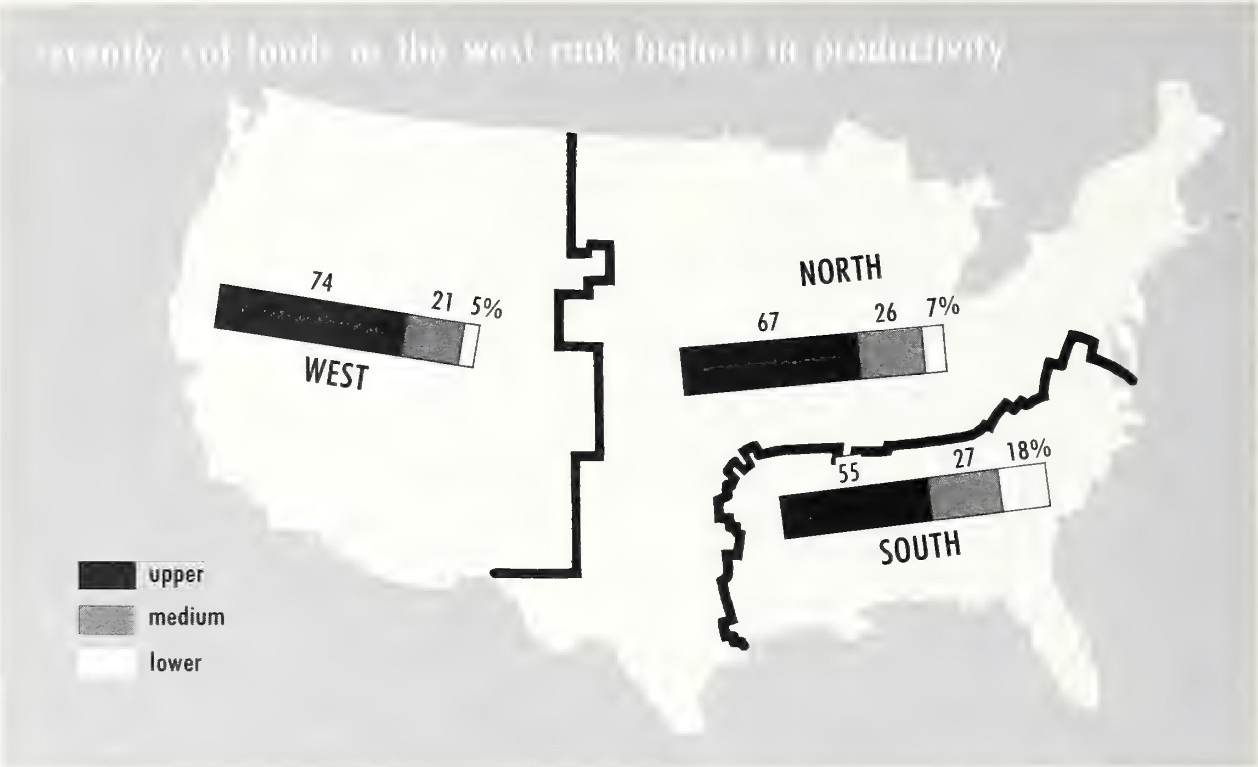


Figure 82

SECTIONAL DIFFERENCES SIGNIFICANT

Recently Cut Lands in the West Rank Highest

Generally the condition of recently cut lands is best in the West, where 74 percent of them were found to be in the upper productivity class (table 139). This is primarily a reflection of the ownership pattern. In the West, 52 percent of all commercial forest land is in national-forest ownership, 12 percent is in large private holdings, and 9 percent consists of other Federal lands. Thus, about three-fourths of all commercial forest land is controlled by three classes of ownership on which substantial portions of recently cut lands attain upper productivity ratings. The result is an overall situation more favorable than in either the North or the South, where small private ownership predominates. Moreover, the proportion of recently cut lands in the upper productivity class on small private ownerships of the West is greater than in the South and about equal to that of the North.

Notable exceptions to the generally better situation in the West are the State and local public ownerships. Only 58 percent of recently cut lands in these ownerships was found to be in the upper productivity class, as compared to 83 percent in the North and 70 percent in the South.

South Has Poorest Conditions

Productive condition of recently cut land is poorer in the South than in the other sections. The range of productivity by ownership class has a greater spread here than elsewhere, and while the highest ratings occur in the South, so also do the lowest, and the latter involves by far the greater acreage.

Recently cut lands on public and on large private ownerships compare very favorably with these holdings in other sections, but the forest area in these ownerships is proportionately smaller in the South. The small private ownerships (less than 5,000 acres) are primarily responsible for the poor average condition of recently cut lands in this section. Only 34 percent of such lands on small holdings were found to be in the upper productivity class, a much lower proportion than in the North and West. The significance of this situation in southern forest economy becomes apparent from the information in table 139 regarding ownership of commercial forest land. This shows that two-thirds of all the South's commercial forest land is in small holdings, and a total of nearly 1.8 million small owners are involved. Almost 80 percent of the land in these small ownerships is in tracts of 500 acres or less (Ownership of Forest Land and Timber, p. 292).

These small ownerships in the South are also of outstanding national significance. They include a total commercial forest area of 128 million acres. This is 36 percent of all private commercial forest land in the United States, and over one-fourth of all commercial forest, both public and private. The total area in these small ownerships exceeds by 11 million acres the entire commercial forest area of the West, and by 66 million acres the commercial forest owned by all the forest industries in the United States. Because of the situation just described, the high potential growth rate, and the greater need for softwood supplies than hardwoods, the top national problem concerned with improving growth by cutting exists on these small ownerships of the South.

Previous evidence (table 136 and fig. 81) has emphasized the significant relation between type of owner and condition of recently cut lands. The generally less favorable conditions found on farm and "other" private lands appear in exaggerated form in the South. Here both these types of ownership have much lower proportions of recently cut lands in the upper productivity class than they do in other sections (appendix section Basic Statistics, table 73).

TABLE 139.—*Productivity of recently cut lands*[1] *in the United States and Coastal Alaska, by section and ownership class, 1953*

Section and ownership class[2]	Commercial forest area		Proportion of operating area by productivity class		
	Total	Operating[3]	Upper	Medium	Lower
	Million acres	*Million acres*	*Percent*	*Percent*	*Percent*
North:					
Small private	118	22	50	33	17
Medium private	8	6	61	30	9
Large private	16	13	71	27	2
National forest	10	9	84	16	(4)
Other Federal	3	1	80	15	5
State and local	19	13	83	16	1
Total or average	174	64	67	26	7
South:					
Small private	128	44	34	37	29
Medium private	20	13	63	26	11
Large private	28	19	81	13	6
National forest	11	9	89	10	1
Other Federal	4	2	83	14	3
State and local	3	1	70	23	7
Total or average	194	88	55	27	18
West:					
Small private	19	8	48	39	13
Medium private	7	4	73	19	8
Large private	14	10	80	17	3
National forest	61	45	79	17	4
Other Federal	11	8	73	23	4
State and local	5	4	58	28	14
Total or average	117	79	74	21	5
Coastal Alaska:					
National forest	3	3	87	13	----------
Other Federal	1	1	100	----------	----------
Total or average	4	4	89	11	----------
Total or average, all sections	489	235	65	24	11

[1] During period January 1, 1947, to date of examination in 1953 or 1954.

[2] Size class based on total commercial forest area in the ownership. Small, 3–5,000 acres in the East, 10–5,000 acres in the West. Medium, 5,000–50,000 acres. Large, 50,000 acres and larger.

[3] Operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some recent cutting was done. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. The figures exclude operating area on some large private ownerships to which access was denied.

[4] Less than 0.5 percent.

The North Shares in Major Problem

Condition of recently cut lands in the North, on the average, falls between the West and the South, but by ownership class this is true only on national forests and other Federal lands. The other classes deviate from this pattern (table 139).

Both the medium and the large private holdings show smaller proportions of recently cut lands in the upper productivity class than was found for these ownerships in the South and West. This is especially marked in the large ownerships, and, as will be shown later, is due primarily to the relatively low proportion of recently cut area in the upper productivity class on large private properties in New England and the Central States. State and local public ownerships rate substantially higher in the North than in either the South or West.

The small private holdings also rate higher in the North, but they are still much below the national average and constitute a problem here as elsewhere. Although less intensified, the situation is similar to that of small owners in the South. Small owners of the North control one-third of all private commercial forest land in all regions, and the individual ownerships average smaller than in other sections so there are proportionately more owners involved.

Strong and Weak Spots Identified by Region and Ownership

Regional differences help to identify important exceptions to the general condition which are glossed over in broad sectional averages. Also comparisons will be made between the proportion of recently cut lands meeting the standards of the upper productivity class for the Nation as a whole and this proportion for ownership classes, geographical locations, or combination of these two. Such comparisons help to show the relative contribution to the national growth level of each segment of forest area, such as an ownership class, locality, or combination thereof.

Segments with proportions of recently cut lands in the upper class lower than the national average tend to hold down the national level of growth. The latter have been termed "weak spots" for purposes of discussion. Conversely, segments with proportions higher than the national average tend to raise the national growth level. These are the strong spots. First, the proportion of recently cut lands in the upper productivity class for each region will be compared with the national average. Second, similar comparisons will be made by types of ownership within each region.

As has been previously pointed out, recently cut lands of the West are in better overall condition than those of the North or South. Most regions of the West exceed the national average (table 140). A notable exception is the Northern Rocky Mountain Region, where the proportion of recently cut lands in the upper productivity class falls slightly below the national average. Recently cut lands in the Pacific Northwest appear to be in somewhat better condition than those of the other western regions, but differences are small.

The fact that recently cut lands in the South are in poorer condition than those of North or West is traceable to both the Southeastern and West Gulf Regions. The West Gulf is especially low with only 46 percent of recently cut lands in the upper productivity class. In the South Atlantic Region, condition of recently cut areas approximates the national average.

In the North, the Lake States Region shows conditions considerably better than those of any other region. Poorest conditions are in the Central and Plains Regions, although the latter is of minor significance in the broad forestry picture.

The following tabulation summarized from table 140 shows for each region how the proportion of recently cut lands in the upper productivity class compares with the national average:

Over 70 percent (exceeds national average)	*60 to 70 percent (approximates national average)*	*Less than 60 percent (below national average)*
Lake States	New England	Central
Pacific Northwest	Middle Atlantic	Plains
California	South Atlantic	Southeast
Southern Rocky Mountain	Northern Rocky Mountain	West Gulf
Coastal Alaska		

Table 141 expands the comparison made above to include consideration of type of ownership. Those ownership classes by region which fall below the national average comprise the weak spots where the condition of recently cut lands is limiting growth most seriously. Conversely, the ownership types by regions with recently cut lands which rate above the national average are those which tend to increase the national growth level. The relative national importance of weak and strong spots can best be judged by the acreage of each in relation to the total area of commercial forest land in the country. Table 142 summarizes this relation for the weak areas. The area within a type of ownership characterized by recently cut lands with productivity below the national average in relation to the total area in the ownership type measures the relative weakness of the ownership type. Table 143 presents these relations. Statistics from these two tables provide the basis for further identification of subaverage localities and types of ownership.

Major Weak Areas on Farms and Other Private Forests

Productivity of recently cut land on farms fell below the national average in all regions but two (table 141). In no region did the productivity of

TABLE 140.—*Productivity of recently cut lands*[1] *in the United States and Coastal Alaska, by section and region, 1953*

Section and region	Commercial forest area		Proportion of operating area by productivity class		
	Total	Operating[2]	Upper	Medium	Lower
North:	*Million acres*	*Million acres*	*Percent*	*Percent*	*Percent*
New England	31	15	63	29	8
Middle Atlantic	42	14	66	23	11
Lake States	53	24	77	20	3
Central	42	11	54	35	11
Plains	6	(3)	13	36	51
Total or average	174	64	67	26	7
South:					
South Atlantic	47	18	64	26	10
Southeast	95	47	57	23	20
West Gulf	52	23	46	34	20
Total or average	194	88	55	27	18
West:					
Pacific Northwest:					
Douglas-fir subregion	25	18	83	13	4
Pine subregion	20	13	79	18	3
Total or average	45	31	81	15	4
California	17	9	77	22	1
Northern Rocky Mountains	34	25	62	27	11
Southern Rocky Mountains	21	14	78	19	3
Total or average	117	79	74	21	5
United States	485	231	65	24	11
Coastal Alaska	4	4	89	11	------------
Total, all regions	489	235	65	24	11

[1] During period January 1, 1947, to date of examination in 1953 or 1954.

[2] Operating area of an individual ownership is the combined area of the forest types, in the ownership, in which some recent cutting was done. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. The figures exclude operating area on some large private ownerships to which access was denied.

[3] Less than ½ million.

recently cut lands on farms exceed the national average. Table 142 shows that farm ownership in these below-average regions contains 31 percent of all commercial forest land in the United States and Coastal Alaska, and from table 143 it is apparent that this area represents 92 percent of all forest land on farms. The major portion of this weak area is concentrated in the Central States, Southeast, and South Atlantic Regions. Here the forest ownership of farms with below-average productivity of recently cut lands comprises 21 percent of all commercial forest land (from table 142) and 61 percent of all farm forest ownerships in the United States (from table 143). The Lake States and West Gulf Regions are also important and, if added, the weak areas on farms in these five regions contain 27 percent of all commercial forest land in the United States and 79 percent of all such land on farms.

Other private lands constitute the second most important weak areas. However, in contrast to farm ownerships, the productivity of recently cut lands on other private ownerships exceeded or approximated the national average in several regions (table 141).

Ownerships of this type with productivity of recently cut lands below the national average contain 18 percent of all commercial forest area in the United States (from table 142) and 67 percent of all such area in other private ownership (from table 143). Similar to farm ownership, the other private lands constituting weak areas are concentrated in a few regions. These are the Middle Atlantic, Central, Southeast, and West Gulf Regions, where other private ownerships with recently cut lands of below-average productivity contain 17 percent of all commercial forest area

and 64 percent of all forest land in this type of ownership.

In summary, the weak areas made up of both farm and other private ownerships comprise 49 percent of all commercial forest land (table 142), with 44 percent, or the bulk of such below-average lands concentrated in six eastern regions. It is here that the greatest opportunity lies for increasing the national level of growth through improved productivity on recently cut lands.

TABLE 141.—*Type of ownership by proportion of operating area in the upper productivity class and by region, United States and Coastal Alaska, 1953* [1]

Proportion of operating area in upper class	Public ownerships				
	National Forest	Bureau of Land Management	Indian	Other Federal	State and local
Above national average (over 70 percent)	New England Middle Atlantic Lake States Central Plains South Atlantic Southeast West Gulf Pacific Northwest California Southern Rocky Mountain Coastal Alaska	West Gulf Pacific Northwest Coastal Alaska	Lake States South Atlantic Pacific Northwest California	South Atlantic Southeast Douglas-fir subregion, Pacific Northwest Southern Rocky Mountain	New England Middle Atlantic Lake States Central South Atlantic Douglas-fir subregion, Pacific Northwest California
Approximating the national average (60–70 percent)	Northern Rocky Mountain	Northern Rocky Mountain Southern Rocky Mountain	....	Central	Southeast
Below national average (below 60 percent)	....	Lake States California	Plains Northern Rocky Mountain Southern Rocky Mountain	New England Middle Atlantic Lake States West Gulf Pine subregion, Pacific Northwest	Plains West Gulf Pine subregion, Pacific Northwest Northern Rocky Mountain Southern Rocky Mountain

Proportion of operating area in upper class	Private ownerships			
	Farm	Pulp manufacturing [2]	All forest industries [2]	Other private
Above national average (over 70 percent)	....	Middle Atlantic Lake States South Atlantic Southeast West Gulf Pacific Northwest California	Middle Atlantic Lake States South Atlantic Southeast Pacific Northwest California Southern Rocky Mountain	New England California
Approximating the national average (60–70 percent)	Middle Atlantic California	....	West Gulf	Lake States Douglas-fir subregion, Pacific Northwest Southern Rocky Mountain South Atlantic
Below national average (below 60 percent)	New England Lake States Central Plains South Atlantic Southeast West Gulf Northern Rocky Mountain Southern Rocky Mountain Pacific Northwest	New England	New England Central Northern Rocky Mountain	Middle Atlantic Central Southeast West Gulf Pine subregion, Pacific Northwest Northern Rocky Mountain

[1] Based on tables 71 and 73, appendix section Basic Statistics.

[2] Lumber and other forest industries not shown separately because sampling was inadequate for valid comparisons by regions for those industries which have substantial proportions of total ownership in small and medium size classes.

TABLE 142.—*Proportion of all commercial forest land in the United States and Coastal Alaska on which productivity of recently cut lands fell below the national average, by section and region and by type of ownership, 1953*

Section and region	All ownerships	Public ownerships						Private ownerships			
		All public	National forest	Bureau of Land Management	Indian	Other Federal	State and local	All private	Forest industries	Farm	Other private
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
North:											
New England	3.0	(1)	------	------	------	(1)	------	3.0	1.7	1.3	------
Middle Atlantic	4.7	(1)	------	------	------	(1)	------	4.7	------	------	4.7
Lake States	3.2	0.1	------	(1)	------	0.1	------	3.1	------	3.1	------
Central	8.0	------	------	------	------	------	------	8.0	.2	5.0	2.8
Plains	.8	.1	------	------	0.1	------	(1)	.7	------	.7	------
Total	19.7	.2	------	(1)	.1	.1	(1)	19.5	1.9	10.1	7.5
South:											
South Atlantic	6.1	------	------	------	------	------	------	6.1	------	6.1	------
Southeast	14.7	------	------	------	------	------	------	14.7	------	9.4	5.3
West Gulf	7.3	.2	------	------	------	.1	0.1	7.1	------	2.9	4.2
Total	28.1	.2	------	------	------	.1	.1	27.9	------	18.4	9.5
West:											
Pacific Northwest:											
Douglas-fir subregion	.6	------	------	------	------	------	------	.6	------	.6	------
Pine subregion	1.0	.1	------	------	------	(1)	.1	.9	------	.5	.4
Total	1.6	.1	------	------	------	(1)	.1	1.5	------	1.1	.4
California	.1	.1	------	0.1	------	------	------	------	------	------	------
Northern Rocky Mountain	2.2	.5	------	------	.2	------	.3	1.7	.5	.8	.4
Southern Rocky Mountain	1.0	.4	------	------	.3	------	.1	.6	------	.6	------
Total	4.9	1.1	------	.1	.5	(1)	.5	3.8	.5	2.5	.8
Coastal Alaska	------	------	------	------	------	------	------	------	------	------	------
Total, all regions	52.7	1.5	------	.1	.6	.2	.6	51.2	2.4	31.0	17.8

1 Less than 0.05 percent.

PUBLIC AND INDUSTRY FORESTS ARE STRONG AREAS

The public lands and the holdings of the forest industries are the major strong areas. Public ownerships with productivity of recently cut lands falling below the national average contain 1.5 percent of all commercial forest area (table 142), and 6.1 percent of all such area in public ownership (table 143). Industry ownerships with below-average productivity on recently cut lands contain 2.4 percent of all commercial forest area and 18 percent of all such area in industry ownership. Thus, weak areas characterize relatively minor proportions of these two types of ownership.

Among the various types of Federal ownership, there are relatively small areas where productivity ratings fell below the national average. National-forest lands in all regions but one rated above it (table 141).

Indian lands in the below-average category comprise less than 1 percent of all commercial forest area, mainly in the West (table 142). However, they constitute 40 percent of all commercial forests on Indian lands (table 143). This situation is reported to result primarily from heavy grazing by sheep and goats, which has adversely affected tree reproduction in the Southern Rocky Mountain Region.

Although representing only 0.2 percent of all commercial forest, 28 percent of the land in other Federal ownership is also characterized by productivity of recently cut lands falling below the national average. These lands include commercial forest on military reservations, game refuges, and in other types of use where production of timber is secondary to the major purposes of administration. Such lands have this characteristic in common with much of the farm and other private forest land.

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TABLE 143.—*Proportion of commercial forest land in the United States and Coastal Alaska, in each ownership type on which productivity of recently cut lands fell below the national average, by section and region, 1953*

Section and region	All ownerships	Public ownerships						Private ownerships			
		All public	National forest	Bureau of Land Management	Indian	Other Federal	State and local	All private	Forest industries	Farm	Other private
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
North:											
New England	3.0	0.1	------	------	------	1.6	------	4.0	13.1	3.7	------
Middle Atlantic	4.7	.2	------	------	------	4.0	------	6.4	------	------	17.5
Lake States	3.2	.4	------	1.1	------	9.0	------	4.2	------	9.2	------
Central	8.0	------	------	------	------	------	------	10.9	1.3	14.9	10.5
Plains	.8	.3	------	------	5.3	------	0.2	1.0	------	2.2	------
Total	19.7	1.0	------	1.1	5.3	14.6	.2	26.5	14.4	30.0	28.0
South:											
South Atlantic	6.1	------	------	------	------	------	------	8.4	------	18.1	------
Southeast	14.7	------	------	------	------	------	------	20.0	------	27.8	19.7
West Gulf	7.3	.8	------	------	------	12.3	1.5	9.7	------	8.6	15.8
Total	28.1	.8	------	------	------	12.3	1.5	38.1	------	54.5	35.5
West:											
Pacific Northwest:											
Douglas-fir subregion	.6	------	------	------	------	------	------	.8	------	1.8	------
Pine subregion	1.0	.6	------	------	------	1.2	2.6	1.2	------	1.4	1.5
Total	1.6	.6	------	------	------	1.2	2.6	2.0	------	3.2	1.5
California	.1	.2	------	5.1	------	------	------	------	------	------	------
Northern Rocky Mountain	2.2	1.9	------	------	11.8	------	6.0	2.4	3.7	2.4	1.6
Southern Rocky Mountan	1.0	1.6	------	------	23.3	------	1.6	.8	------	1.7	------
Total	4.9	4.3	------	5.1	35.1	1.2	10.2	5.2	3.7	7.3	3.1
Coastal Alaska	------	------	------	------	------	------	------	------	------	------	------
Total, all regions	52.7	6.1	------	6.2	40.4	28.1	11.9	69.8	18.1	91.8	66.6

Forest lands under administration of the Bureau of Land Management on which recently cut lands rated below the national average comprise only 0.1 percent of all commercial forest land and 6.2 percent of all land in this type of public ownership. The bulk of this area is in the California Region.

State and local public ownerships in the below-average category also comprise less than 1 percent of all commercial forest land and about 12 percent of all land in these forms of public ownership. These lands are concentrated primarily in the pine subregion of the Pacific Northwest, and the Northern Rocky Mountain, Southern Rocky Mountain, and West Gulf Regions.

Productivity of recently cut lands on ownerships of the forest industries fell below the national average only in the New England, Central, and Northern Rocky Mountain Regions (table 141). The bulk of the weak area in this type of ownership is in New England, but here it constitutes only 1.7 percent of all commercial forest land (table 142) and 13 percent of all such land in the ownerships of the forest industries.

PRODUCTIVITY VARIES WITH SIZE OF TREES LEFT AFTER CUTTING

Previous explanation of concepts (pages 228–229) has shown that the same productivity indexes could be attained by either large or small trees left on the ground after cutting. Thus identical productivity indexes were possible whether residual stands were seedlings and saplings, pole-size trees, sawtimber trees, or any combination of these size classes, provided the effects of composition and premature cutting were the same. Obviously seedling and sapling stands will constitute the stocking on areas which have been recently clear cut. Conversely, residual sawtimber stands will be the prevailing stand size class where some degree of partial cutting has been practiced in

sawtimber. Poletimber stands left after cutting may result either from partial cutting in stands which were poletimber prior to cutting or from a substantial clear cutting of all sawtimber in stands of mixed sizes.

The productivity of residual seedling and sapling stands as compared to that of sawtimber stands reveals the relative efficiency of clear cutting and partial as now applied, in maintaining the productivity of recently cut lands. Residual poletimber stands are of little value in such a comparison since they may result either from partial cuttings or substantial clear cuttings.

Productivity Generally Highest for Residual Sawtimber

For all regions combined, 78 percent of the sawtimber stands left on recently cut lands was found to be in the upper productivity class, as compared to 58 percent for seedling and sapling stands (table 144). In both the North and South, over 80 percent of the sawtimber stands left on recently cut areas was in the upper class. Much lower percentages of seedling and sapling stands in these two sections occurred in the upper class. The spread in productivity between the two stand size classes in the West was much less—75 percent for sawtimber stands as compared to 80 percent for seedlings and saplings. Thus, partial cutting as currently applied is generally superior to the methods of clear cutting now used in the North and South. In the West, the two methods are about equally effective in maintaining productivity of recently cut lands, clear cutting being perhaps slightly the more effective.

Both clear cutting and partial cutting methods have a place in American forestry. Either of these contrasting methods of cutting can maintain recently cut lands in a high state of productivity provided the method chosen is appropriate for the forest type, the vigor and age class of timber, and other conditions prevailing on the area to be cut over. Although clear cutting has resulted in lower productivity than has partial cutting in several important regions and classes of ownership, this does not imply that clear cutting is inadvisable in such areas. Major causes of low productivity after clear cutting appear to be failure to provide adequate seed sources, seedbed, or other conditions on recently cut lands.

Lowest Productivity in Seedling and Sapling Stands of Small Eastern Ownerships

In each of the three sections of the country, the productivity of both sawtimber and seedling and sapling stands on recently cut lands of small private ownerships is lower than on other classes of ownership. Neither clear cutting nor partial cutting methods are applied as effectively on small private holdings as on other ownership classes. However, the lowest productivity was found to result from clear cutting on small ownerships of the North and South and from partial cutting on small ownerships of the West. Since 246 million acres or 50 percent of the commercial forest land

TABLE 144.—*Percent of recently cut lands*[1] *in the upper productivity class, in the United States and Coastal Alaska, by ownership class, section, and stand size class, 1953*

Section and stand size class[2]	Ownership class				
	Small private	Medium and large private	National forest	Other public	All ownerships
North:					
Sawtimber	71	95	94	82	83
Seedlings and saplings	35	44	72	84	55
South:					
Sawtimber	51	88	95	91	84
Seedlings and saplings	28	77	81	58	44
West:					
Sawtimber	34	73	78	70	75
Seedlings and saplings	55	85	83	82	80
Coastal Alaska:					
Sawtimber					
Seedlings and saplings			87	100	89
Total, all regions:					
Sawtimber	58	85	81	74	78
Seedlings and saplings	32	69	82	81	58

[1] During period Jan. 1, 1947, to time of examination in 1953 or 1954.

[2] Seedling and sapling class includes areas of prospective stocking.

in all regions is on small private ownerships of the North and South combined (table 139), clear-cutting methods, as now practiced on small ownerships, are a major obstacle to improvement in the national growth level. Small ownerships of the West constitute about 4 percent of all commercial forest lands in the country. Because of the relatively small area involved, the low productivity associated with the present use of partial cutting methods on these small private holdings is less important nationally although there may be important local implications.

In addition to the small ownerships already mentioned, productivity of clear-cut areas was relatively low on medium and large private ownerships of the North and other public lands in the South. With these exceptions, both partial cutting and clear-cutting methods resulted in 70 percent or more of recently cut lands in the upper productivity class on medium and large private ownerships, national forests, and other public lands in all three sections of the country.

Class of Product Cut Related to Productivity of Cutovers

The output of pulpwood in the United States has about doubled since 1940. Yet in spite of this great increase in pulpwood use, the heaviest demand is still for the larger size products. About 70 percent of the timber volume being cut is in the form of saw logs, veneer logs, piling, and cooperage bolts (Growth and Utilization, table 95, p. 156).

Two-thirds of Cutting Primarily for Large Sizes

During the survey, the recent cutting on each ownership examined was classified as to size of products harvested. On 65 percent of all recently cut lands, the cutting was principally for large products (table 145). On only 15 percent was the cutting primarily for small products such as pulpwood, fence posts, and fuelwood. On the other 20 percent, cutting was for both large and small products.

The cut in the West, reflecting the general size of timber available, was almost all for large products. Here even the pulpwood comes primarily from logs of sawtimber size rather than cordwood.

In the South, where output of pulpwood is greater than any other section, cutting for small products primarily was limited to 17 percent of recently cut lands. Large products were the principal products removed on 59 percent of recently cut lands. Obviously, a large share of the pulpwood in this section comes from cutting

TABLE 145.—*Proportion of recently cut lands in the United States and Coastal Alaska, by size class of products harvested, section, and ownership class, 1953*

Ownership class [1]	Operating area [2]	Class of products harvested [3]		
		Large	Both large and small	Small
	Million acres	*Percent*	*Percent*	*Percent*
North:				
Small private	22	57	20	23
Medium and large private	19	27	19	54
National forest	9	25	71	4
Other public	14	17	60	23
Total or average	64	35	36	29
South:				
Small private	44	64	17	19
Medium and large private	32	55	25	20
National forest	9	47	51	2
Other public	3	54	39	7
Total or average	88	59	24	17
West:				
Small private	8	89	4	7
Medium and large private	14	96	3	1
National forest	45	95	5	(4)
Other public	12	98	2	(4)
Total or average	79	95	4	1
Coastal Alaska:				
National forest	3	100	0	0
Other public	1	100	0	0
Total or average	4	100	0	0
All sections:				
Small private	74	64	17	19
Medium and large private	65	56	18	25
National forest	66	79	20	1
Other public	30	55	33	12
Total or average	235	65	20	15

[1] Size class of private ownership based on total commercial forest area in the ownership. Small, 3–5,000 acres in the East; 10–5,000 acres in the West. Medium, 5,000–50,000 acres. Large, 50,000 acres and larger.

[2] The operating area on an individual ownership is the combined area of the forest types, within the ownership, in which some recent cutting was done. The operating area of any size class or type of ownership is the sum of operating areas on individual ownerships in that size class or type of ownership. Figures exclude operating area on some large ownerships to which access was denied.

[3] Large: Cuttings on which large products like saw logs, veneer bolts, and stave bolts comprise 80 percent or more of the total cubic foot volume of products harvested.

Small: Cuttings on which small products such as cordwood, fuelwood, fence posts, etc., comprise 80 percent or more of the products harvested.

Both large and small: Cuttings on which both large and small products were harvested and neither made up 80 percent of the volume.

[4] Less than 0.5 percent.

on the other 24 percent of the operating area where both large and small products were removed.

Nearly a third of recently cut lands in the North were cut for small products primarily. Over a half of such lands in medium and large private ownerships were cut for small products. This is in sharp contrast to the South and West. A part of the reason for this contrast is the large area in the North and particularly the Lake States of species such as aspen, black spruce, and balsam, which mature at cordwood rather than sawtimber sizes. Such species are suitable primarily for pulpwood.

In both the North and South, higher proportions of recently cut lands were cut for a combination of large and small products on national forest and on other public lands than on other types of ownership.

Highest Productivity on Integrated Operations

With some exceptions, integrated operations harvesting both large and small logs and bolts from the same cutting area are usually considered to be associated with advanced forest practices. This is generally substantiated by the results shown in table 146. Nationally, for all ownerships, 73 percent of recently cut lands were in the upper productivity class where both large and small products were harvested. This exceeds the productivity resulting from harvest of a single size class of product, either large or small.

Integrated operations result in greater productivity on medium and large private ownerships, the national forests, and other public lands. However, on small private ownerships, the proportion of recently cut lands in the upper productivity class is at about the same low level whether the cutting removes large products primarily, small products, or both.

Harvest of small products primarily results in greater productivity than does harvest of large products on medium and large private ownerships and on other public lands. This is probably due to the growing tendency tc harvest small products by thinning or partial cutting in stands of poletimber. Apparently the cutting methods used in harvesting products of large size primarily are less effective in maintaining productivity of recently cut areas.

On small private ownerships, 40 percent of land recently cut for small products is in the upper productivity class compared to 39 percent for other product size classes. This distinction is probably not significant. The amount of cutting for small products primarily is negligible on national forests and no valid comparison can be made.

TABLE 146.—*Productivity of recently cut lands* [1] *in the United States and Coastal Alaska, by ownership class and size class of products harvested, 1953*

Ownership class [2] and class of products cut	Operating [3] area	Proportion of operating area by productivity class		
		Upper	Medium	Lower
	Million acres	*Percent*	*Percent*	*Percent*
Small private:				
Large products	47	39	38	23
Both large and small	13	39	35	26
Small products	14	40	26	34
Medium and large private:				
Large products	37	69	24	7
Both large and small	12	85	12	3
Small products	16	73	22	5
National forest:				
Large products	52	82	14	4
Both large and small	13	85	15	0
Small products	1	100	---	---
Other public:				
Large products	17	77	19	4
Both large and small	10	87	13	(4)
Small products	3	86	11	3
All owners:				
Large products	153	65	24	11
Both large and small	48	73	19	8
Small products	34	61	22	17

[1] During period January 1, 1947, to date of examination 1953 or 1954.

[2] Size class of private ownership based on total commercial forest land in the ownership. Small, 3–5,000 acres in the East; 10–5,000 acres in the West. Medium, 5,000–50,000 acres. Large, 50,000 acres and larger.

[3] Operating area on an individual ownership is the combined area of the forest types, within an ownership, in which some recent cutting occurred. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Figures exclude operating area on some large ownerships to which access was denied.

[4] Less than 0.5 percent.

CONDITIONS RESPONSIBLE FOR LOW PRODUCTIVITY

In the preceding pages, a general picture of the productivity of recently cut lands has been presented by size class and type of ownership, and the major variations related to geographical location, class of ownership, and other factors have been explored. Next will be identified the key conditions on these recently cut lands responsible for failures to meet standards of the upper productivity class.

This will be accomplished by separate appraisal of the proportion of recently cut lands in the upper productivity class when measured on the basis of each individual rating element. Thus, the proportion of recently cut lands in the upper productivity class will be discussed when stocking

only is considered. The effects of species composition and premature cutting in modifying the stocking rating will also be discussed separately.

Stocking Most Significant Element in Productivity

Existing stocking as determined by the survey of recently cut land consists of crop trees left on the ground after cutting plus any which may have become established between the time cutting was completed and the date of examination by the survey. This interval varied from 7 years to only a few months. Frequently then, the field examination occurred at a time when stocking of new growth was incomplete and changing rapidly, especially on clear cuttings. Thus, any analysis of existing stocking alone could easily prove misleading with respect to future productivity on recently cut lands. After careful estimates of the prospects for further stocking are made and added to existing stocking, the resulting totals give a much better measure of the probable effect of stocking on growth following cutting.

Total stocking shows many significant variations by both major sections of the country and by ownership classes, but it consistently exerts the greatest influence of the several elements contributing to the combined productivity ratings. For example, figure 83 shows that 40 percent of recently cut land on small private ownerships was found to be in the upper productivity class. It shows further that the remaining 60 percent, which constitutes a deduction from a feasible 100 percent, consisted of 43 percent due to total stocking on the ground which fell below the 70 percent minimum required by the upper stocking standard, 6 percent due to the composition standard not being met, and 11 percent due to premature cutting. A similar relation between total stocking and the other rating elements was found for each broad ownership class and major section of the country.

Stocking Poorest on Small Ownerships

On the basis of total stocking (existing plus prospective), 74 percent of all recently cut lands meet standards for the upper level of stocking (table 147 and fig. 84). However, there are marked differences between broad ownership classes. Little over half (57 percent) of the recently cut lands in small ownerships have attained upper level stocking standards as compared to slightly more than 80 percent for private owners of medium and large size and for public forests. The major stocking deficiencies on these small ownerships are in the South and West. Here the proportion of recently cut lands qualifying for upper stocking standards is substantially below the national average for all ownerships. Over 30 percent of all commercial forest lands are in the small ownerships of these two sections. Stocking on small ownerships of the North about equals the national average for stocking. This is partly due to the large proportion of hardwood types where establishment of reproduction is relatively easy.

Lack of Provision for Future Crops Responsible.—Prospects of future stocking are much poorer for small ownerships than for other classes. Comparisons of existing and total stocking for the continental United States shows that on small ownerships only 19 percent of recently cut lands qualify for upper stocking standards on the basis of prospective stocking only (table 147). Comparable increases for other ownership classes equal or exceed 30 percent. Small private ownerships show a similar weakness with respect to prospective stocking in all three major sections of the country.

Conditions on the ground after cutting that affect the establishment of new tree crops are, therefore, much less favorable on small private ownerships than on others. Corrective measures require a variety of positive actions. These vary widely by forest types, methods of cutting used, economic possibilities, and other factors. In some situations, only one or two simple changes may accomplish great improvement—in others a more complex combination of treatments is required.

Stocking Deficiencies Greatest in the South

The proportion of recently cut lands meeting upper standards for total stocking is 83 percent in the North and 77 percent in the West. These proportions both exceed the national average of 74 percent. However, the score for total stocking in the South—65 percent—is considerably below the national average.

Recently cut areas on public lands in the South have met upper standards for total stocking as well or better than public lands elsewhere. The comparatively low rating in the South is due primarily to the conditions found on private lands and particularly on small private ownerships. Only 48 percent of recently cut lands in small southern ownerships met high standards for total stocking, the poorest stocking in the country. The fact that half of the operating area in the South was found to be in these small ownerships is primarily responsible for the low overall stocking in this section. The proportion of recently cut lands meeting upper standards for stocking on medium and large private ownerships of the South exceeds the national average but is lower than for this class of ownership in either North or West.

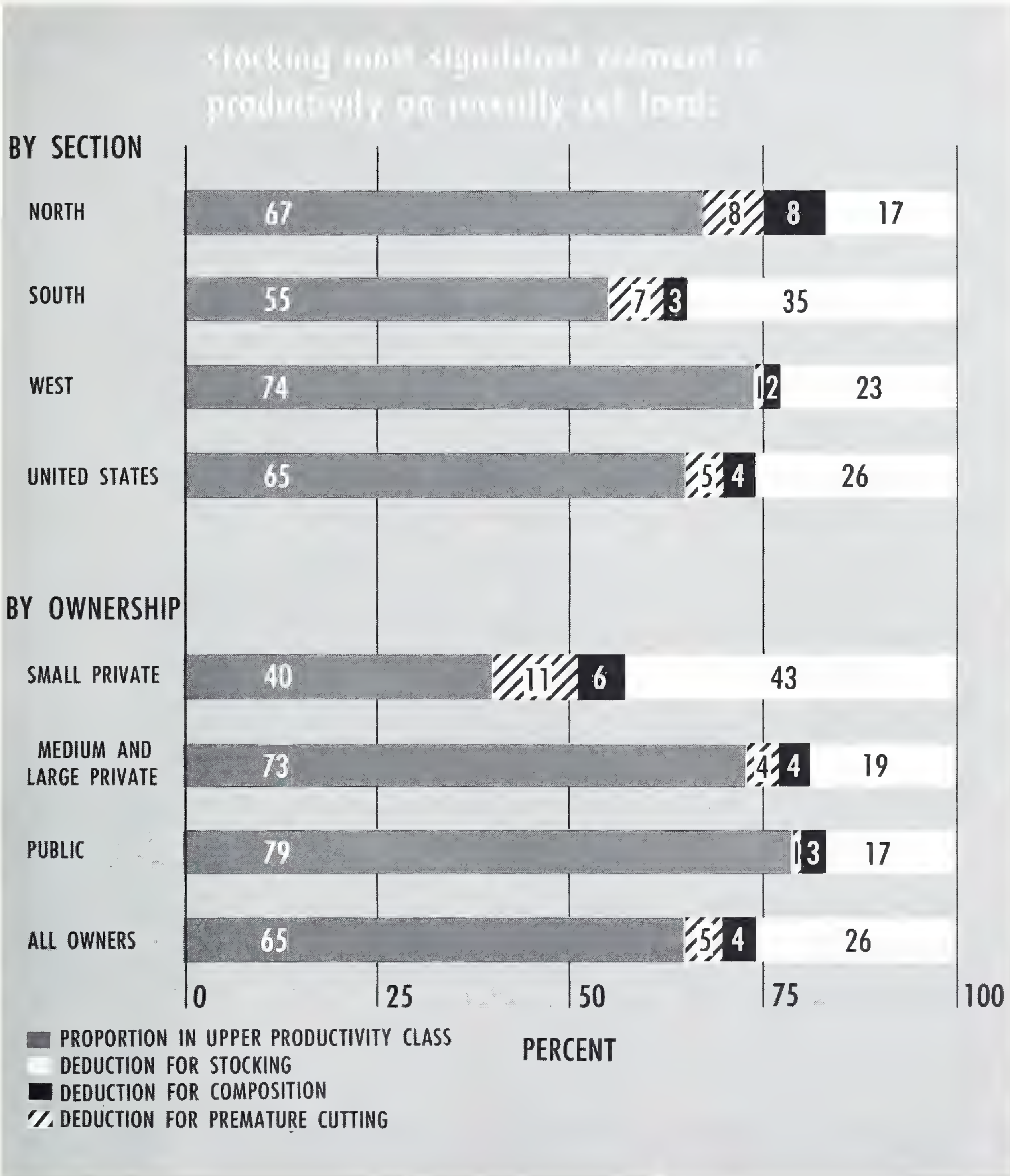
BY SECTION
NORTH
67
8
8
17
SOUTH
55
7
3
35
WEST
74
1
2
23
UNITED STATES
65
5
4
26
BY OWNERSHIP
SMALL PRIVATE
40
11
6
43
MEDIUM AND LARGE PRIVATE
73
4
4
19
PUBLIC
79
1
3
17
ALL OWNERS
65
5
4
26
0
25
50
75
100
PERCENT
PROPORTION IN UPPER PRODUCTIVITY CLASS
DEDUCTION FOR STOCKING
DEDUCTION FOR COMPOSITION
DEDUCTION FOR PREMATURE CUTTING

Figure 83

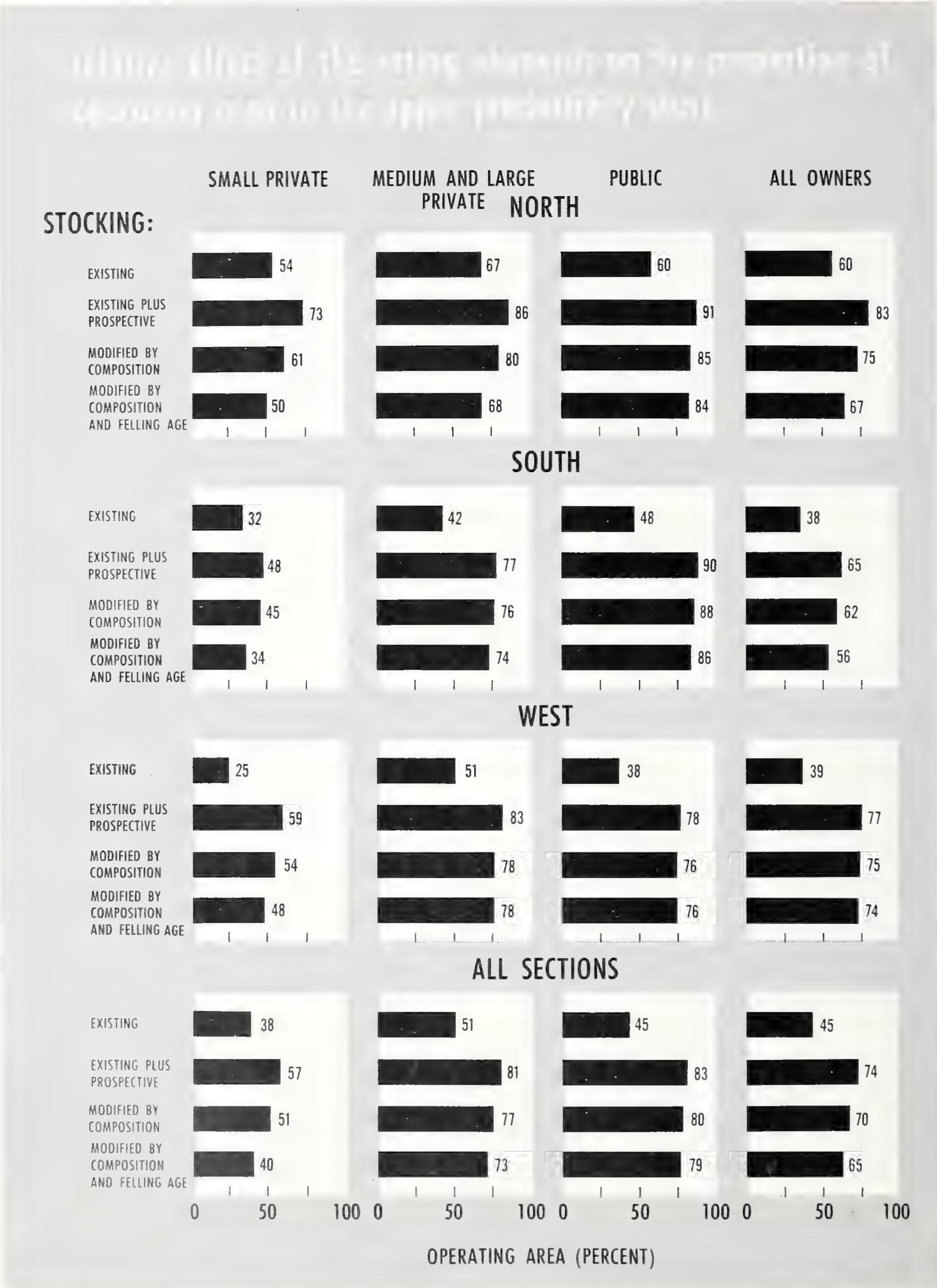
SMALL PRIVATE
MEDIUM AND LARGE PRIVATE
PUBLIC
ALL OWNERS
STOCKING:
NORTH
EXISTING 54 67 60 60
EXISTING PLUS PROSPECTIVE 73 86 91 83
MODIFIED BY COMPOSITION 61 80 85 75
MODIFIED BY COMPOSITION AND FELLING AGE 50 68 84 67
SOUTH
EXISTING 32 42 48 38
EXISTING PLUS PROSPECTIVE 48 77 90 65
MODIFIED BY COMPOSITION 45 76 88 62
MODIFIED BY COMPOSITION AND FELLING AGE 34 74 86 56
WEST
EXISTING 25 51 38 39
EXISTING PLUS PROSPECTIVE 59 83 78 77
MODIFIED BY COMPOSITION 54 78 76 75
MODIFIED BY COMPOSITION AND FELLING AGE 48 78 76 74
ALL SECTIONS
EXISTING 38 51 45 45
EXISTING PLUS PROSPECTIVE 57 81 83 74
MODIFIED BY COMPOSITION 51 77 80 70
MODIFIED BY COMPOSITION AND FELLING AGE 40 73 79 65
0 50 100 0 50 100 0 50 100 0 50 100
OPERATING AREA (PERCENT)

Figure 84

TABLE 147.—*Productivity of recently cut lands in the United States and Coastal Alaska, by rating element, section, and ownership class, 1953*

Section and ownership class [1]	Commercial forest area		Proportion of operating area by productivity class for—											
	Total	Operating [2]	Existing stocking only			Total stocking (existing plus prospective stocking)			Stocking modified by composition			Stocking and composition modified by felling age [3]		
			Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower
	Million acres	*Million acres*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
North:														
Small private	118	22	54	30	16	73	19	8	61	27	12	50	33	17
Medium and large private	24	19	67	27	6	86	13	1	80	18	2	68	28	4
Public	32	23	60	35	5	91	9	(4)	85	15	(4)	84	16	(4)
Total or average	174	64	60	31	9	83	14	3	75	20	5	67	26	7
South:														
Small private	128	44	32	34	34	48	33	19	45	34	21	34	37	29
Medium and large private	48	32	42	41	17	77	16	7	76	17	7	74	18	8
Public	18	12	48	43	9	90	9	1	88	10	2	86	12	2
Total or average	194	88	38	38	24	65	23	12	62	25	13	55	27	18
West:														
Small private	19	8	25	51	24	59	35	6	54	37	9	48	39	13
Medium and large private	21	14	51	39	10	83	16	1	78	18	4	78	17	5
Public	77	57	38	53	9	78	18	4	76	19	5	76	19	5
Total or average	117	79	39	50	11	77	19	4	75	21	4	74	21	5
United States:														
Small private	265	74	38	35	27	57	29	14	51	32	17	40	36	24
Medium and large private	93	65	51	36	13	81	15	4	77	17	6	73	21	6
Public	127	92	45	47	8	83	15	2	80	17	3	79	17	4
Total or average	485	231	45	40	15	74	19	7	70	22	8	65	24	11
Coastal Alaska: Public	4	4	87	13	0	89	11	0	89	11	0	89	11	0
Total or average, all sections	489	235	45	40	15	74	19	7	70	22	8	65	24	11

[1] Size class of private ownerships based on total commercial forest area in the ownership. Small, 3–5,000 acres in the East; 10–5,000 acres in the West. Medium, 5,000–50,000 acres. Large, 50,000 acres or larger.

[2] Operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. The figures exclude operating area on some large private ownerships to which access was denied.

[3] Final combined rating.

[4] Less than 0.5 percent.

EFFECTS OF SPECIES COMPOSITION

Substandard Species Composition Has Limited Effect

In a previous discussion of concepts, the standard of species composition adopted for each type was described. Application of this standard to the stocking rating results in a reduced rating if less than 50 percent of the stocking consists of desirable species. In some cases, this reduction is great enough to drop the rating from upper to medium or even to the lower class. In other cases, it may not be large enough to change the productivity class. Thus, an individual rating of 85 for total stocking may drop to 75 when composition is considered, but the rating still remains in the upper class since the range in ratings for this class is 70 to 100. The statistics of table 147, then, show the proportion of recently cut lands sufficiently affected by substandard composition to be reduced from one rating class to another. The percentages of all recently cut lands which were lost from the upper class because of substandard composition are summarized in the following tabulation:

Ownership class:	*North (percent)*	*South (percent)*	*West (percent)*	*All sections (percent)*
Small private	12	3	5	6
Medium and large private	6	1	5	4
Public	6	2	2	3
All ownerships	8	3	2	4

This shows that nationally 4 percent of recently cut lands were lost from the upper productivity class because of substandard composition. Although it has much less effect on productivity than stocking, substandard composition occurs on all ownership classes in all sections of the country.

Substandard Composition Most Prevalent in the North

The greatest loss of recently cut lands from the upper productivity class because of substandard composition occurs in the North. Here 8 percent of such lands on all ownerships were found to have substandard composition. This is several times the percentage of area so affected in the South and West.

Small private ownerships of the North are the most seriously affected by substandard composition. Here 12 percent of recently cut lands were lost from the upper productivity class. This is twice the reduction on other ownerships of that section. In the West, loss of area from the upper class was 5 percent for small private ownerships and also for the larger private ownerships. This is over twice the reduction found on public lands of the West. In the South, composition problems are again greatest on small private ownerships, and least on medium and large private lands. Public lands occupy an intermediate position.

The high proportion of commercial forest area in the hardwood type groups in the North (76 percent as compared to 29 percent in the South—appendix section Basic Statistics, table 21) helps explain why substandard composition is most prevalent in the North. Losses in the percentage of recently cut land from the upper productivity class due to substandard composition are generally greater in hardwood than in softwood type groups (appendix section Basic Statistics, table 77). This results from cutting the species of higher value and leaving on the ground those of lesser value. Repetition of this process gradually reduces the proportion of desirable species in a stand, and this is particularly serious in hardwood type groups which usually are characterized by a large number of species classed as commercial. A substantial number of these species have limited utility for wood products and are classified in the standards as acceptable species only. With a few exceptions, softwood type groups are less affected by substandard composition than hardwood type groups. This is due to the relatively small differences in the utility of softwood species where such species grow in mixture.

Premature Cutting Affects 30 Percent of Recently Cut Lands

The effect of felling age or premature cutting upon growth has been previously discussed as one of the basic elements for appraising the productivity of recently cut lands. Reasons were presented to show how clear cutting of forest stands prior to attainment of peak growth reduces the amount of wood that can be grown despite good stocking and composition. The degree to which premature cutting limits growth in any area depends upon the prevalence of such cutting and the relative maturity of the clear-cut stands.

The prevalence of premature cutting is shown in table 148. The figures include all areas where adjustments in the productivity rating were made

Table 148.—*Proportion of operating area[1] in the United States and Coastal Alaska on which premature cutting occurred, by section and region and by ownership class, 1953*

Section and region	Ownership class[2]: Small private	Medium and large private	Public	All owners
	Percent	*Percent*	*Percent*	*Percent*
North:				
New England	83	81	38	78
Middle Atlantic	64	63	46	60
Lake States	25	13	18	19
Central	38	51	2	32
Plains	42	------	48	44
Average	51	63	21	44
South:				
South Atlantic	46	22	7	32
Southeast	59	17	6	37
West Gulf	68	26	3	41
Average	58	21	5	37
West:				
Pacific Northwest:				
Douglas-fir subregion	53	17	19	24
Pine subregion	56	2	3	9
Average	54	14	10	18
California	2	2	------	1
Northern Rocky Mountain	42	9	3	6
Southern Rocky Mountain	16	------	------	1
Average	44	10	4	9
United States	54	30	9	30
Coastal Alaska	------	------	------	------
Average, all regions[3]	54	30	9	29

[1] Operating area of an individual ownership is the combined area of the forest types, in the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership.

[2] Size class of private ownership based on total commercial area in the ownership. Small, 3–5,000 acres in the East, 10–5,000 acres in the West. Medium, 5,000–50,000 acres. Large, 50,000 acres and larger.

[3] No premature cutting was revealed by the sample of recent cuttings in Coastal Alaska.

for effects of felling age. All degrees of this effect, both large and small, are included.

Growth is being adversely affected to some degree by premature cutting on 29 percent of the recently cut lands in all regions combined. Over half of the recently cut area in small private ownerships is thus affected, compared to 30 percent for medium and large private holdings and 9 percent for public lands. This concentration of premature cutting on small private ownerships, nationally, also occurs in the West and South, but in the North it is also important on private ownerships of medium and large size. Premature cutting on public ownerships is also more prevalent in the North than in other sections.

Premature Cutting Most Prevalent in the East

Among the various regions, those of the West show relatively limited prevalence, although in the Douglas-fir subregion of the Pacific Northwest this factor has reached substantial proportions as the second growth there comes into operable size. In all regions of the West except California, the proportion of recently cut lands affected by premature cutting is much greater on small private ownerships than on other ownership classes. In California, very little premature cutting was found and equal proportions occur in both size classes of private ownership.

The amount of premature cutting occurring in the western regions is small, due partly to the large proportion of commercial forest area in national-forest and other public ownerships and a substantial portion in the larger private ownerships. The forest management policies of many of these ownerships aim to capture as much of the growth potential as possible. However, another factor responsible is the concentration of current cutting on mature or overmature stands which have reached or passed the age of peak annual growth. Here little opportunity exists for premature cutting. Because of the commitments to forest management policies on public and some private lands and the large proportions of commercial forest area in such ownerships, premature cutting will probably not become as prevalent in the West as elsewhere. Whether it will increase on other lands, after all old-growth timber is cut, to the extent now found in the North and South will depend upon the degree to which forest management policies are adopted on these other lands.

Among the regions of the North and South, premature cutting is most prevalent in New England (78 percent) and the Middle Atlantic States (60 percent), least prevalent in the Lake States (19 percent). A third or more of recently cut lands are affected to some degree by premature cutting in all other regions of the North and South.

Premature Cutting Limits Productivity Mainly on Small Private Ownerships

The discussion immediately preceding has shown the prevalence of premature cutting within the various sections, regions, and ownership classes of the country without regard to the effect on productivity. The last columns of table 147 show the degree to which premature cutting is reducing the proportion of recently cut lands in the upper productivity class.

As previously noted, the proportion of recently cut land meeting upper standards for stocking and composition was 70 percent for the country as a whole. When standards for rating the effect of felling age are also included, this percentage drops to 65. Thus, premature cutting is responsible for a loss of 5 percent in the area of all recently cut lands on which productivity was rated in the upper class.

The percentages of recently cut area lost from the upper productivity class because of premature cutting are summarized for each section and ownership class in the following tabulation:

Ownership class:	*North (percent)*	*South (percent)*	*West (percent)*	*All sections (percent)*
Small private	11	11	6	11
Medium and large private	12	2	0	4
Public	1	2	0	1
All ownerships	8	7	1	5

This shows that in the North where greatest productivity losses from premature cutting occur (8 percent in all ownerships) all classes of private lands contribute to the problem. In the South and West, losses are confined principally to small private ownerships. Nationally, the proportion of recently cut lands lost from the upper productivity class because of premature cutting was 11 percent for small private ownerships. This is nearly 3 times the loss for the larger private ownerships and 11 times that for the public lands.

A basic consideration in avoiding premature cutting is careful discrimination among second-growth stands of timber which have developed operable volumes of merchantable products. Within a given species or type, there are stands, usually the younger, with still increasing volumes of annual growth. Often these can be harvested profitably. In contrast are similar second-growth stands, usually older, which have reached or nearly reached the age of greatest growth when little, if any, subsequent increase in growth can be expected. These can be operated profitably with greater recovery of volume than if cut at any earlier age. Premature cutting consists of clear cutting the first type of stand mentioned above before the peak of mean annual growth has been reached. Discrimination between these two broad types of second-growth stands and substitution of

thinnings or other partial cuttings in those which have not completed their growth cycle would help to raise the national level of growth.

Premature Cutting Sometimes Unavoidable

In passing, it should be noted that often a small amount of premature cutting is unavoidable or even of advantage to the long-range maintenance or improvement of growth. Individual logging units on large forests frequently cover considerable acreages and may contain small patches or stands of immature but operable timber. In some situations, such as mountainous areas mainly of old-growth timber, the methods of logging necessary are such that the small area of young stands cannot be reserved from cutting. Or they may pass the period of peak growth before another cut in the area is possible. In such cases, premature cutting is to be expected.

A situation sometimes occurs where premature cutting is advantageous to maintenance of growth. This occurs where past fires of large size, rapid liquidation cutting, or a combination of both was followed by development of a single age class or very few age classes of young timber. Unless premature cutting is carefully done to develop a better distribution of age classes, large areas of timber will mature more rapidly than they can be harvested, with the result that in some species losses in yield due to overmaturity may equal or exceed those due to premature cutting. The aspen type of the Lake States is an example of this.

Thus, a controlled amount of premature cutting has a definite and constructive part to play where long-range plans are aimed at attaining an ultimate balance of age classes for sustained yield of forest products. However, situations where premature cutting is beneficial in any sense are few and occur on only a small fraction of the recently cut lands in any of the three sections of the country.

Study by Forest Type Groups Further Identifies Deficiencies

The foregoing discussion helps define the geographic areas, ownership classes, and conditions of recently cut lands responsible for limiting the national level of growth insofar as timber cutting is concerned. This can be sharpened considerably by consideration of forest type in addition to the factor of ownership class and productivity elements.

Statistics of table 149 provide the basis for comparing the proportions of recently cut lands in the upper productivity class for each forest type group with the national average. These statistics also provide by type groups a basis for appraising the effect of each rating element on the proportion of recently cut lands in the upper class. Such appraisals can also be made by broad ownership groups.

Softwood Type Groups of East and West Contrast Sharply

In the tabulation on the next page, productivity on recently cut lands for each type group is compared to the national average by summary of data from table 149. The area of commercial forest land in each type is also shown (from table 21, appendix section Basic Statistics).

The first part of the tabulation shows that the nine type groups with recently cut lands exceeding the national average in productivity contain about one-third of all commercial forest land in the United States. The strongest component consists of six western forest type groups. Their total area is about twice that of the maple-beech-birch and aspen-birch type groups, which are the only two eastern type groups where recently cut lands exceed the national productivity average. The absence of eastern softwood type groups is noteworthy. Only two western softwood type groups did not qualify for this category.

Two eastern softwood type groups—spruce-fir and longleaf-slash pine—are the only ones with recently cut lands approximating the national productivity average. Together they comprise nearly 10 percent of all commercial forest land in the country. Both are highly important in the sections where they occur.

The recently cut lands of all other eastern softwood and mixed hardwood-softwood type groups are below the national productivity average and constitute major weak spots. The loblolly-shortleaf pine type group is the largest softwood type group in the country and is included in this category. Eastern type groups producing softwoods with recently cut lands showing productivity below the national average contain 27 percent of all commercial forest land. In addition to these, two western type groups—western white pine and larch—are also weak spots. Together they occupy 2 percent of all commercial forest land.

Softwoods supply the highest proportion of our annual timber cut from growing stock. During 1952, in all regions, the cut of softwoods from living trees 5 inches or more in diameter was 7.5 billion cubic feet or 69 percent of the 10.8 billion cubic-foot total (table 49, appendix section Basic Statistics). In view of their current importance and the tight softwood supply situation projected for the future, the absence of eastern softwood type groups in the better-than-average category is of considerable national significance.

	Total area of type group [1] (million acres)	Proportion of all commercial forest area (percent)
Forest type groups with more than 70 percent of recently cut lands in the upper productivity class (exceeding the national average [2]):		
Eastern hardwoods:		
Maple-beech-birch	33. 45	6. 8
Aspen-birch	23. 45	4. 8
Total	56. 90	11. 6
Western softwoods:		
Douglas-fir	31. 73	6. 5
Hemlock-spruce	7. 81	1. 6
Redwood	1. 59	. 3
Ponderosa pine	37. 46	7. 7
Lodgepole pine	14. 47	3. 0
Fir-spruce	13. 62	2. 8
Total	106. 68	21. 9
Western hardwoods	3. 94	. 8
Total	167. 52	34. 3
Forest type groups with 60–70 percent of recently cut lands in the upper productivity class (approximately the national average [2]):		
Eastern softwoods:		
Spruce-fir	21. 46	4. 4
Longleaf-slash pine	26. 49	5. 4
Total	47. 95	9. 8
Forest type groups with less than 60 percent of recently cut lands in the upper productivity class (below the national average [2]):		
Eastern softwoods:		
White-red-jack pine	10. 30	2. 1
Loblolly-shortleaf pine	58. 51	12. 0
Total	68. 81	14. 1
Eastern mixed types:		
Oak-pine	22. 89	4. 7
Oak-gum-cypress	40. 29	8. 3
Total	63. 18	13. 0
Eastern hardwoods:		
Oak-hickory	112. 21	23. 1
Elm-ash-cottonwood	18. 28	3. 7
Total	130. 49	26. 8
Western softwoods:		
Western white pine	5. 38	1. 1
Larch	4. 42	. 9
Total	9. 80	2. 0
Total	272. 28	55. 9

[1] The total of all type group areas falls short of the total commercial forest area by the acreage in the pinyon-juniper type of the West in which no recently cut lands were examined.

[2] In this tabulation, the national average percentage of recently cut lands in the upper productivity class is taken as a range of 60 to 70 percent rather than the mean of 65 percent. This range was indicated by the sampling accuracy of estimate shown in table 84, appendix section Adequacy of Data.

Hardwood Type Groups of Largest Area Below Average in Productivity

The oak-hickory and elm-ash-cottonwood type groups constitute the major weaknesses in hardwoods. Their combined area comprises 27 percent of all commercial forest land. The oak-hickory group with its many important subtypes covers more commercial forest land (112 million acres) than any other type group. It is widely distributed over both the North and the South, as is the smaller elm-ash-cottonwood group. The combined area of these two type groups (130 million acres) is over twice as large as the combined area of the maple-beech-birch and aspen-birch type groups, on which productivity of recently cut lands exceeds the national average.

Weak Spots by Forest Type Groups Identified by Rating Element and Ownership Class

In table 149, the deductions for each type group and ownership class represent the proportion of recently cut lands which did not qualify for the standards set up in the Criteria. For example, 35 percent of recently cut lands of the white-red-jack pine type group on small ownerships met all standards of the Criteria sufficiently well to qualify for the upper productivity class. The deductions show that 46 percent of recently cut lands did not qualify for the upper class because stocking standards were not reached. Seven percent of the area of recently cut lands was lost to the upper class because the composition standard was not reached, and another 12 percent was lost due to premature cutting. The sum of the deductions and the proportion of area in the upper productivity class always equals 100, thus accounting for all recently cut land in each forest type group-owner class combination.

The deduction of 46 percent because of stocking in the white-red-jack pine type group in small ownerships is greater than the average stocking deduction for all type groups on all ownerships (26 percent). Thus, stocking in this type group on small private ownerships is deficient in comparison with average stocking countrywide, and this tends to hold down or place limitations on the national level of growth. All such comparisons from table 149 (indicated by boldface type) were used as the basis for identifying weak spots. The major weak spots are shown in figure 85.

Stocking Deficiencies Mainly in Softwood Type Groups on Small Ownerships

The boldface figures in table 149 reaffirm a previous finding that stocking on small private ownerships is a major reason why the recently cut lands on such ownerships are below the

TABLE 149.—*Proportion of recently cut lands in the United States and Coastal Alaska in the upper productivity class and deductions* [1] *for rating elements, by ownership class and forest type group, 1953* [2]

Forest type group	Small private ownerships					Medium and large private ownerships				
	Operating area	Proportion in upper class	Deduction for—			Operating area	Proportion in upper class	Deduction for—		
			Stocking	Composition	Premature cutting			Stocking	Composition	Premature cutting
	Million acres	*Percent*	*Percent*	*Percent*	*Percent*	*Million acres*	*Percent*	*Percent*	*Percent*	*Percent*
East:										
White-red-jack pine	2.17	35	**46**	**7**	**12**	0.57	79	11	**9**	1
Spruce-fir	2.28	42	**31**	**6**	**21**	8.16	73	12	0	**15**
Loblolly-shortleaf pine	21.65	36	**51**	2	**11**	11.09	81	15	1	3
Longleaf-slash pine	7.63	29	**61**	1	**9**	12.07	75	24	1	0
Oak-pine	4.13	43	**47**	2	**8**	1.42	68	24	1	**7**
Oak-gum cypress	4.05	26	**51**	**13**	**10**	5.60	55	**37**	**7**	1
Oak-hickory	17.30	40	**34**	**14**	**12**	4.95	59	23	**12**	**6**
Elm-ash-cottonwood	.56	37	24	**35**	4	.02	100	0	0	0
Maple-beech-birch	5.37	67	14	**8**	**11**	5.83	71	9	**12**	**8**
Aspen-birch	1.65	74	26	0	0	.71	95	5	0	0
West:										
Douglas-fir	3.69	56	**36**	2	**6**	5.39	83	15	1	1
Hemlock-Sitka spruce	.28	64	26	**5**	5	1.75	95	5	0	0
Redwood	.16	75	25	0	0	.72	90	10	0	0
Ponderosa pine	2.41	29	**54**	**9**	**8**	4.31	72	25	3	0
Western white pine	.17	27	**73**	0	0	.47	31	**68**	1	0
Lodgepole pine	.33	65	20	1	**14**	.36	96	4	0	0
Larch	.21	76	21	3	0	.68	34	7	**59**	0
Fir-spruce	.11	32	**55**	**13**	0	.85	88	12	0	0
Hardwoods	.02	50	**27**	**23**	0	----------	----------	----------	----------	----------
All types	74.17	40	**43**	**6**	**11**	64.95	73	19	4	4

Forest type group	Public ownerships					All ownerships				
	Operating area	Proportion in upper class	Deduction for—			Operating area	Proportion in upper class	Deduction for—		
			Stocking	Composition	Premature cutting			Stocking	Composition	Premature cutting
	Million acres	*Percent*	*Percent*	*Percent*	*Percent*	*Million acres*	*Percent*	*Percent*	*Percent*	*Percent*
East:										
White-red-jack pine	2.70	68	20	**12**	0	5.44	56	**29**	**10**	5
Spruce-fir	4.32	77	11	**9**	3	14.76	69	15	4	**12**
Loblolly-shortleaf pine	3.73	90	5	0	5	36.47	55	**35**	2	**8**
Longleaf-slash pine	2.71	93	5	2	0	22.41	62	**34**	1	3
Oak-pine	1.61	91	3	**6**	0	7.16	59	**32**	3	**6**
Oak-gum cypress	.47	60	**32**	4	4	10.12	44	**42**	**9**	5
Oak-hickory	7.54	85	11	3	1	29.79	54	**27**	**11**	**8**
Elm-ash-cottonwood	.23	42	**34**	**24**	0	.81	40	26	**31**	3
Maple-beech-birch	4.73	94	4	2	0	15.93	76	9	**8**	**7**
Aspen-birch	6.65	85	10	**5**	0	9.01	84	12	4	0
West:										
Douglas-fir	14.02	79	20	1	0	23.10	77	21	1	1
Hemlock-Sitka spruce	5.43	90	10	0	0	7.46	90	10	0	0
Redwood	.07	100	0	0	0	.95	88	12	0	0
Ponderosa pine	21.74	79	19	2	0	28.46	73	23	3	1
Western white pine	1.84	16	**83**	1	0	2.48	20	**79**	1	0
Lodgepole pine	8.28	90	8	2	0	8.97	89	8	2	1
Larch	2.71	42	**52**	**6**	0	3.60	43	**41**	**16**	0
Fir-spruce	6.60	72	26	2	0	7.56	73	25	2	0
Hardwoods	.38	77	23	0	0	.40	75	24	1	0
All types	95.76	80	16	3	1	234.88	65	26	4	5

[1] Boldface figures indicate deductions exceeding the national average deduction for each element. National averages are stocking, 26 percent; composition, 4 percent; premature cutting, 5 percent.

[2] Computed from appendix table 77, appendix section Basic Statistics. Figures show the deductions in proportion of area in the upper class due to standards for each rating element not being met. For example, table 77 of the Basic Statistics shows that 54 percent of recently cut lands in the white-red-jack pine type group on small private ownerships met upper stocking standards. Thus, 46 percent of such lands did not meet such standards and is the deduction. Further, table 77 shows that when effects of composition were considered, the proportion of area in the upper productivity class changed from 54 percent to 47 percent, a loss of 7 percent due to failure to meet composition standards. When premature cutting was considered, the proportion of area in the upper productivity class changed from 47 percent to 35 percent, a loss of 12 percent due to premature cutting. These losses or deductions allow direct comparisons of the relative importance of the elements by forest type groups and ownership classes.

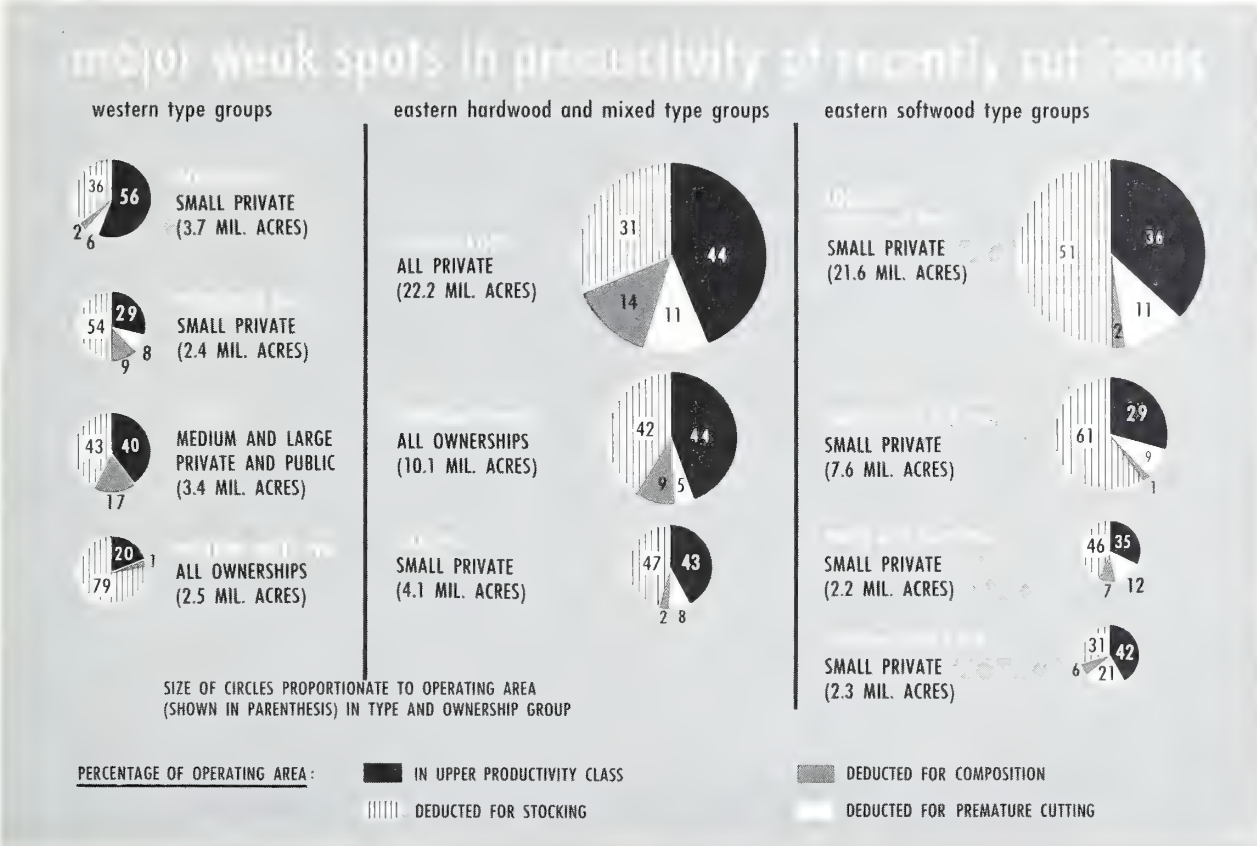

Figure 85

national average in productivity. They show further that the stocking deficiencies of small ownerships are concentrated on 12 of the 19 forest type groups. Eight of these are softwood type groups, two are mixed hardwood-softwood and two are hardwood groups. The eight softwood type groups consist of all four eastern softwood type groups and the western white pine, fir-spruce, ponderosa pine, and Douglas-fir type groups of the West. Both of the mixed softwood-hardwood type groups of the East are deficient in stocking on small ownerships. Of the hardwood type groups, oak-hickory and western hardwoods show stocking deficiencies on these ownerships.

Deductions show that stocking deficiencies are usually greater for softwood than for hardwood type groups and that such deficiencies are slightly greater in western softwood than eastern softwood type groups on small ownerships.

Four type groups show stocking deficiencies in the larger private and public ownerships combined. Two of these, western white pine and oak-gum-cypress, are deficient in stocking on both of these ownership groups. The western larch and elm-ash-cottonwood type groups show stocking deficiencies on public lands only.

The western white pine type group requires special consideration. The situation shown in table 149 and figure 85 is traceable primarily to the Northern Rocky Mountain Region and does not apply to the sugar pine phase of this type group in California and Oregon. Although covering a comparatively restricted area, the high value of this species and the specialized products derived from it makes this species of much greater importance than its limited distribution would imply. Stocking deficiencies are related primarily to the serious nature of the white pine blister rust. Control of this disease requires special cutting methods on ownerships attempting long-term management of western white pine, particularly the national forests. The cutting methods adopted consist of a series of partial cuts spaced some years apart, which stimulate germination of the wild currant and gooseberry plants that serve as alternate hosts for the blister rust, but at the same time provide sufficient shade and other environmental conditions to decimate them after germination. By thus reducing the population of the rust's alternate host, the ultimate costs of digging, poisoning, or otherwise removing these plants is much lower than if the overmature areas scheduled

for cutting first were immediately clear cut and regenerated either naturally or by planting. The necessary shade to provide this decimating effect on the alternate host is provided primarily by species associated with white pine, such as hemlock and grand fir, which are often highly defective and unmerchantable on current markets. However, possibilities of an early demand for these species as pulpwood appear good. Sales for this purpose would accomplish removal of these species more economically than burning them over. Unfortunately, the biology of the situation is such that the shade necessary to reduce direct blister rust control costs prevents prompt natural regeneration of white pine.

The long-term policy of managing western white pine on the national forests, therefore, is unavoidably to hold recently cut areas in a state of limited productivity for a period of years in order to later realize greater returns from a reduced investment in direct control of blister rust.

In contrast to this policy, most private owners are not committed to a similar long-term policy of growing western white pine. Some of these private lands receive the benefits of direct blister rust control programs, but a large proportion of the white pine type on private lands is not included in this program. Here conversion of the white pine type to other species not susceptible to blister rust appears as the only solution, and in this situation these substitute species have been recognized in the rating criteria as desirable in the stocking of recently cut lands. Thus, on recently cut national-forest lands in blister rust protection areas, deficiencies in stocking relate to current deficiencies in the stocking of white pine while outside protection zones, including most private land, stocking deficiencies relate primarily to species other than white pine.

Composition Deficiencies Less Concentrated Than Stocking Deficiencies

For all ownerships combined and for small ownerships, deficiencies in composition occur in fewer type groups than do stocking deficiencies. However, the reverse is true on the larger private and on public ownerships. On small properties, there are 10 type groups deficient in composition. Four of these are hardwood, 5 are softwood, and one is the eastern mixed type group, oak-gum-cypress.

Deductions show that composition deficiencies are usually greater on small private ownerships for hardwood than for softwood type groups. An exception is the maple-beech-birch type group. Among the softwood groups, two western types, fir-spruce and ponderosa pine, show somewhat higher deductions for composition than do the two eastern types, white-red-jack pine and spruce-fir. However, the hemlock-Sitka spruce type group of the West shows the smallest reduction of all the type groups that are deficient in composition on small ownerships.

On the larger private ownerships, five type groups are deficient in composition and of these four are eastern type groups. Two are important eastern hardwood type groups, one is the white-red-jack pine type group, and the fourth is oak-gum-cypress of the South. The larch type group is the only western one with composition deficiencies on medium and large private ownerships.

Six type groups are deficient in composition on public ownerships. Two are eastern softwoods found mostly in the North. They are white-red-jack pine and spruce-fir. The other softwood is western larch. Of the remaining three type groups, one is the aspen-birch of the North, and the last two, elm-ash-cottonwood and oak-pine, are distributed generally in the East.

The absence of composition deficiencies in pine type groups of the South warrants special comment in view of discussion in other chapters of this report regarding the softwood area in the South which has been replaced by hardwoods. There are two reasons why composition deductions for southern pine type groups in table 149 do not exceed the national average deduction. First, the standards for rating composition in several of the southern subtypes recognize the better hardwoods as desirable species along with the softwoods. In these subtypes, a replacement of softwoods by the better hardwoods could take place without change in a rating for composition. Second, table 149 shows that some deductions due to composition were present in the three southern type groups containing pine even though such deductions did not exceed the national average. The small percentage deductions for composition applied to the large operating area in these type groups involve substantial areas on which composition standards were not met after cutting.

Premature Cutting Mainly Affects Eastern Type Groups on Small Ownerships

On small ownerships, eleven type groups show deficiencies due to premature cutting. Eight of these are native to the East. Generally, on small ownerships, the eastern softwood type groups show greater deficiencies due to premature cutting than do the western softwood type groups. An exception is lodgepole pine, which is second only to the eastern spruce-fir type group in order of deficiencies due to premature cutting.

Four of the type groups identified with small ownerships also show deficiencies due to premature cutting on the larger private ownerships. All are eastern type groups. Of these, the greatest deficiency is in the spruce-fir type group. Others which have about equal deficiency are maple-beech-birch, oak-pine, and oak-hickory.

Deficiencies due to premature cutting do not appear on public lands.

INTENSIFIED SURVEY ON WEST COAST

In order to show additional detail, and following consultation with foresters and others on the West Coast, a plan was completed to intensify the survey of recently cut lands there. The standard survey had already begun and field examiners were not required to re-examine areas already covered in order to obtain additional records. Therefore, the additional data needed for the intensified survey was not collected in six counties of northeastern Washington, one county west of the Cascades in that State, and one county in western Oregon. In California, over half the field work on the standard productivity survey had been completed, so that additional information was collected on less than half of the area scheduled for examination. For this reason, results are presented only for the Pacific Northwest.[43]

Collection of supplementary data began in March 1954. The data collected in addition to that of the standard survey consisted of (a) the acreage cut over on the areas sampled, (b) reasons for nonstocking as observed by field examiners, (c) tally of species comprising stocking both before and after cutting in order to detect change, (d) whether partial or clear-cutting methods had been used, (e) tally of felling ages to show by age classes proportion of cutover area which was clear cut. Aside from table 150, which presents statistics on commercial forest area, operating area, and area cut over in a single year by ownership classes, no attempt has been made to expand other sample data to obtain broad regional averages. Instead, results are expressed as percentages of the total number of sample points examined on recently cut lands within ownership classes, forest type groups, or combinations of these two.

Area of Recent Cutting

The survey indicated that annual cutting during recent years approximates 630 thousand acres or 1.5 percent of the entire commercial forest area (table 150). However, careful examination of individual field tally sheets indicates that field instructions were not uniformly followed and that some field examiners failed to obtain full information on total area recently cut on the larger private and public ownerships. A bias was thus introduced in final results which show low cutover area figures for large private and public lands.

[43] After preliminary analysis of the limited amount of additional field data taken in California, the Forest Service felt that results would not be sufficiently reliable for publication. However, copies of preliminary tabulations will be provided to those who have use for them.

Table 150.—*Commercial forest area, operating area, and estimated area cut in one year in the Pacific Northwest,[1] by ownership class*

Class of ownership	Commercial forest area	Operating area	Approximate area cut in 1 year [2]	Percent of commercial area cut in 1 year
	Thousand acres	*Thousand acres*	*Thousand acres*	*Percent*
PRIVATE HOLDINGS BY SIZE CLASS				
10–100 acres	2, 004	627	80	4. 0
100–500 acres	3, 271	1, 643	116	3. 5
500–5,000 acres	3, 058	2, 095	105	3. 4
Total, small private	8, 333	4, 365	301	3. 6
5,000–50,000 acres	2, 887	2, 183	48	1. 7
50,000 and larger	6, 460	5, 567	73	1. 1
Total, all size classes	17, 680	12, 115	422	2. 4
HOLDINGS BY TYPE OF OWNERSHIP				
Private:				
Farm	5, 048	2, 658	231	4. 6
Lumber manufacturing	6, 717	5, 839	85	1. 3
Pulp manufacturing	1, 681	1, 431	24	1. 4
Other wood manufacturing	341	224	10	2. 9
Other private	3, 893	1, 963	72	1. 9
All private	17, 680	12, 115	422	2. 4
Public:				
National forest	16, 080	10, 432	113	. 7
Bureau of Land Management	2, 564	2, 289	14	. 5
Indian	2, 169	1, 852	51	2. 4
Other Federal	58	52	1	1. 7
State	2, 450	2, 168	26	1. 5
County and local	505	197	3	. 6
Total	23, 826	16, 990	208	. 9
Total, all ownerships	41, 506	29, 105	630	1. 5

[1] Excludes area in northeastern Washington in U. S. Forest Service Region 1 that was not covered in the supplemental survey.

[2] Although estimated from the best data available these are, for most classes of ownership, approximations only. Based principally on 1947 for the western portion of the region and 1952 for the eastern portion.

Stocking Poorest on Small Ownerships

Both the standard survey (table 77, appendix section Basic Statistics) and recalculation of original stocking data on a sample point basis (table 151) show that in the Pacific Northwest stocking is poorest for all forest type groups on

small private ownerships. The greatest deficiency occurs in the ponderosa pine type group on small holdings. Here 33 percent of the points examined were not stocked and had no prospect of early stocking. In the Douglas-fir type group, 27 percent on small private and 24 percent on medium and large private lands were also nonstocked.

TABLE 151.—*Proportion of sample points not stocked and with no prospect of stocking, by forest type and ownership class, Pacific Northwest, 1954*

Forest type group	Ownership class			
	Small private[1]	Medium and large private[2]	National forest[3]	Other public[4]
	Percent	*Percent*	*Percent*	*Percent*
Douglas-fir	27	24	11	20
Hemlock-Sitka spruce	17	14	8	12
Ponderosa pine	33	9	10	15
Other types	14	7	8	11

[1] Based on 17,807 points on 53,691 acres of recent cutting examined.
[2] Based on 12,807 points on 64,568 acres of recent cutting examined.
[3] Based on 9,908 points on 60,861 acres of recent cutting examined.
[4] Based on 12,536 points on 59,974 acres of recent cutting examined.

Brush and Poor Seed Sources Major Causes of Stocking Failure

The intensified survey attempted to identify the major reasons for nonstocking where this condition was found. For each nonstocked point, field examiners recorded their judgment as to probable reason for nonstocking. The results are summarized in table 152.

Most common cause for lack of stocking on recently cut lands in the Pacific Northwest was attributed to some form of ground cover. The proportion of nonstocking due to cull trees, brush, sod, and other ground cover varies from 58 percent in the ponderosa pine to 85 percent in the "other" type groups. The greatest single cause of failure was brush cover in all but the ponderosa pine, where perennial sod was considered more important than brush.

Inadequate seed source is also important in the three major type groups. Especially critical from this standpoint is ponderosa pine, where 30 percent of the unstocked points were charged to lack of seed source.

A surprisingly small proportion of the stocking failures was attributed to rodents and similar causes. Apparently rodent losses are not easily identified in this type of survey. It is probable that some nonstocking resulting from the eating or storing of seed by rodents may have been recorded as being caused by the more obvious factors such as the ground cover that harbors the rodents.

TABLE 152.—*Reasons for nonstocking on recently cut lands, by forest type group, Pacific Northwest, 1954*

Reason for nonstocking	Forest type group			
	Douglas-fir[1]	Hemlock-Sitka spruce[2]	Ponderosa pine[3]	Other[4]
	Percent	*Percent*	*Percent*	*Percent*
Seed—inadequate source	14	15	30	6
Ground cover:				
Cull or noncommercial species	13	16	8	3
Brush	44	39	21	37
Perennial sod	8	5	24	21
Deep slash, logs, and stumps	9	12	5	24
Site conditions:				
Severe	4	4	5	2
Rock, water, roads, etc	5	6	7	6
Rodents, other animals, and miscellaneous	3	3	(5)	1
Total	100	100	100	100

[1] Based on 28,791 points on 83,767 acres of recent cutting examined.
[2] Based on 6,255 points on 24,226 acres of recent cutting examined.
[3] Based on 14,978 points on 120,469 acres of recent cutting examined.
[4] Based on 3,034 points on 10,632 acres of recent cutting examined.
[5] Less than 0.5 percent.

In any event, the steps needed to hold to a minimum the amount of unstocked and understocked cutovers in the Pacific Northwest involve principally the reduction of inhibiting ground cover and the improvement of the seed source, the latter especially in ponderosa pine.

Species Composition Changed by Cutting

Reduction in productivity ratings of the standard survey due to poor composition was smaller in the West than in the rest of the country, as shown by table 147. The Pacific Northwest rates at least as good in this respect as the average for the West. In the major forest type groups, the loss in rating due to composition was small (table 77, appendix section Basic Statistics). The prior discussion of concepts for the standard productivity survey showed that composition on the ground was measured in comparison with standards appropriate for each type. The supple-

mental data on species composition for the Pacific Northwest was collected and tabulated under a different concept. Here the species constituting the stocking on the ground at the time of examination were recorded. In addition, field examiners were required to determine the species constituting the stocking prior to logging by examination of stumps and other available evidence. A comparison of the composition before and after logging was prepared from these two sets of records and is summarized in table 153. Data are presented separately for clear cuttings and partial cuttings.

TABLE 153.—*Composition of stocking*[1] *before and after cutting, by ownership class and forest type group, Pacific Northwest, 1954*

CLEAR CUTTING

Forest type group and species	Small private ownership		Medium and large private ownership		National-forest ownership		Other public ownership	
	Before cutting	After cutting	Before cutting	After cutting	Before cutting	After cutting	Before cutting	After cutting
Douglas-fir:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Douglas-fir	92	70	71	66	66	80	71	63
Hemlock	2	6	15	18	22	12	14	19
Western redcedar	2	5	10	8	8	3	8	7
White fir	(2)	8	1	3	2	1	1	5
Other	4	11	3	5	2	4	6	6
Total	100	100	100	100	100	100	100	100
Ponderosa pine:								
Ponderosa pine	91	70	71	49	37	84	[illegible]	53
Douglas-fir	7	20	16	14	47	16	26	20
White fir	(2)	1	13	37	16	(2)	6	21
Other	2	9	(2)	(2)	(2)	(2)	3	6
Total	100	100	100	100	100	100	100	100
Hemlock-Sitka spruce:								
Hemlock	85	80	85	77	69	49	73	78
Sitka spruce	8	11	2	11	(2)	1	5	5
Douglas-fir	3	2	3	3	12	37	3	3
Western redcedar	2	2	5	2	16	8	13	9
Other	2	5	5	7	3	5	6	5
Total	100	100	100	100	100	100	100	100

PARTIAL CUTTING

Forest type group and species	Small private ownership		Medium and large private ownership		National-forest ownership		Other public ownership	
	Before cutting	After cutting	Before cutting	After cutting	Before cutting	After cutting	Before cutting	After cutting
Douglas-fir:								
Douglas-fir	95	77	76	49	68	52	81	69
Hemlock	(2)	3	2	4	9	13	1	5
Western redcedar	1	3	(2)	1	4	6	5	8
White fir	1	1	6	12	3	9	3	3
Ponderosa pine	(2)	8	11	17	5	11	4	5
Other	3	8	5	17	11	9	6	10
Total	100	100	100	100	100	100	100	100
Ponderosa pine:								
Ponderosa pine	91	85	73	64	81	79	85	73
Douglas-fir	9	12	22	21	6	10	13	18
White fir	(2)	3	2	8	10	6	(2)	6
Other	(2)	(2)	3	7	3	5	2	3
Total	100	100	100	100	100	100	100	100

[1] Based on points that were stocked both before and after cutting and on which a cut stump indicated that the point was affected by the cutting.

[2] Less than 0.5 percent.

Representation of Douglas-Fir in Its Type Group Drops Except on National-Forest Clear Cuttings

In the Douglas-fir type group, on small private ownerships the representation of Douglas-fir on clear cuttings dropped from 92 percent before cutting to 70 percent after cutting. This change was accompanied by increases in the proportion of western hemlock and redcedar, white fir and other species. On medium and large private ownerships in this type group, the reduction of Douglas-fir was 5 percent. A slight reduction also was found in the proportion of western redcedar. Other species increased slightly. Similar changes took place on other public lands. On recently cut areas of the national forests, the representation of Douglas-fir increased from 66 percent before cutting to 80 percent after cutting. Associated species such as western hemlock and redcedar and white fir were reduced, but a slight gain for other species was recorded.

Thus, for clear cuttings in the Douglas-fir type group, the changes in species resulting from logging were a significant loss in the representation of Douglas-fir on small private ownerships accompanied by gains in the representation of other species, smaller losses in the proportions of Douglas-fir on medium and large private ownerships and other public lands, and substantial gains in the representation of Douglas-fir on the national forests.

Partial cutting in the Douglas-fir type group resulted in substantial losses in the representation of Douglas-fir on all ownership classes. There were either increases or minor changes in the associated species.

Ponderosa Pine Loses Ground on All Ownerships

On clear cuttings in the ponderosa pine type group, the representation of ponderosa pine dropped over 20 percent on both size classes of private ownership. A smaller decrease was found on other public lands, but a large increase in the proportion of ponderosa pine was found on the very small portion of national-forest area which was clear cut in this type group. On small private ownerships, the loss in representation of ponderosa pine after clear cutting was accompanied by an increase in Douglas-fir. However, on all other ownership classes, the proportion of Douglas-fir in the ponderosa pine type group was reduced by clear cutting. White fir showed increases on medium and large private ownerships and on other public lands. The representation of white fir was reduced considerably on the very small area of national-forest clear cuttings.

Partial cuttings in ponderosa pine type groups showed losses in the representation of ponderosa pine on recently cut lands of all ownership classes. Smallest losses occurred on national-forest cuttings—greatest on other public lands. Douglas-fir increased slightly on all ownership classes except for those of the medium and large private ownerships. White fir increased slightly on all ownership classes except the national forests, where a decrease was found. Other species where present increased slightly.

Hemlock Partly Replaced by Sitka Spruce and Other Species in Hemlock-Spruce Type Group

In the hemlock-Sitka spruce type group, clear cutting was used so universally on all ownership classes that no adequate information can be presented for partial cuttings. On clear-cut areas, the proportion of hemlock was reduced on all private ownership classes and a large reduction occurred on recently cut lands of the national forests; the representation of hemlock increased somewhat on other public lands. The representation of Sitka spruce increased slightly or remained unchanged. About the same situation was found to exist with respect to Douglas-fir except on national-forest lands, where an increase of 25 percent in the representation of Douglas-fir took place. The proportion of western redcedar declined in all ownership classes except for small private ownerships, where it remained unchanged. The representation of other species increased slightly on all ownerships except for other public lands, where a minor decrease was found.

Clear Cutting Common in Most Types

Clear cutting is the predominant cutting method in the Douglas-fir and hemlock-Sitka spruce type groups on all ownerships, although this method is applied on only a little more than half of the Douglas-fir type group in national-forest ownership (table 154). On small private lands ponderosa pine also is almost entirely clear cut, but on other ownerships partial cuts are generally made in this type group. In the other type groups, the practice is to clear cut on private lands and partial cut on most of the public lands. It is significant to note that cutting on the small private ownerships is almost entirely clear cutting regardless of the forest type involved.

TABLE 154.—*Proportion of cutting classed as clear cutting, by forest type and ownership group, Pacific Northwest, 1954*

Forest type group	Ownership class			
	Small private [1]	Medium and large private [2]	National forest [3]	Other public [4]
	Percent	*Percent*	*Percent*	*Percent*
Douglas-fir	87	79	58	85
Hemlock-Sitka spruce	89	99	93	98
Ponderosa pine	96	23	(5)	10
Other	84	100	17	28

[1] Based on 53,691 acres of recent cutting examined.
[2] Based on 64,568 acres of recent cutting examined.
[3] Based on 60,861 acres of recent cutting examined.
[4] Based on 59,974 acres of recent cutting examined.
[5] Less than 0.5 percent.

PROPORTION OF CLEAR CUTTING BY AGE CLASSES

Regeneration through clear cutting is an accepted silvicultural practice well adapted to many mature and old-growth forests that are still common in the West. Unfortunately, clear cutting is also being practiced on very young second-growth stands. Table 155 summarizes by ownership classes the ages at which clear cutting is being done in the three major type groups of the Pacific Northwest. These data show that for each forest type group higher proportions of the young age classes are being clear cut on small private ownerships than on other ownership classes. The proportion of clear cutting in young age classes is lower on the medium and large private ownerships than on small ownerships. However, the proportion of clear cutting in young age classes is greater on these larger private lands than on the public lands.

The highest proportions of clear cutting in young age classes take place in the Douglas-fir type group, although substantial proportions also occur in hemlock-Sitka spruce.

Interpretations of the importance of clear cutting in these young stands have been discussed on pages 230–232.

SUMMARY

The major results of the survey of recently cut lands are as follows:

1. Nationally, 56 percent of the recently cut lands in private ownership and 80 percent of those in public ownership were found to be in the upper productivity class. For all ownerships combined, 65 percent of recently cut lands were in the upper productivity class. About three-fourths of all commercial forest land is in private ownership.
2. Recently cut lands on public ownerships and on the ownerships of forest industries are at

TABLE 155.—*Proportion of clear cutting by age class and ownership class for three major forest type groups, Pacific Northwest, 1954*

Age class (years)	Douglas-fir [1]				Ponderosa pine [2]		Hemlock-Sitka spruce [3]			
	Small private ownerships	Medium and large private ownerships	National forest	Other public	Small private ownerships	Medium and large private ownerships	Small private ownerships	Medium and large private ownerships	National forest	Other public
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
20–40	4	0	0	(4)	0	(4)	1	(4)	0	0
40–60	23	6	(4)	3	(4)	0	12	5	(4)	3
60–80	23	8	(4)	4	3	0	15	5	2	7
80–100	18	10	4	12	5	1	38	17	4	11
100–120	4	5	3	4	3	1	10	10	2	5
120–160	8	13	10	17	23	13	9	18	22	18
160–200	14	10	17	28	19	20	9	23	26	20
200+	6	48	66	32	47	65	6	22	44	36
Total	100	100	100	100	100	100	100	100	100	100

[1] Based on 28,791 points on 83,767 acres of recent cutting examined.
[2] Based on 14,978 points on 120,469 acres of recent cutting examined. In the ponderosa pine type group on public lands the amount of clear cutting encountered in the sample was too small to provide reliable figures by age classes for these lands.
[3] Based on 6,255 points on 24,226 acres of recent cutting examined.
[4] Less than 0.5 percent.

about the same general level of productivity. The proportions of these lands in the upper productivity class by ownership groups are pulp industry, 84 percent; national forests, 81 percent; other public ownerships, 77 percent; lumber and other wood-manufacturing industries, 73 percent.

3. In contrast, the proportions of recently cut lands in the upper productivity class were much lower on farm and other private forest lands. The proportions were farm, 41 percent; other private, 52 percent.
4. The national significance of this contrast is emphasized by the area of commercial forest land in these two broad ownership groups. About 193 million acres or 39 percent of all commercial forest land is found on ownerships of the public and of the forest industries, while 296 million acres or 61 percent of the total is in farm and other private ownership.
5. Condition of recently cut lands is closely related to size of private ownerships. Proportions of recently cut lands in the upper productivity class are small private, 40 percent; medium private, 64 percent; and large private, 78 percent. Public lands taken together showed 80 percent of recently cut lands in the upper productivity class. Small private forest ownerships are largely on farms and on other private lands. Together these numerous small properties contain 265 million acres or 54 percent of all commercial forest land.
6. The condition of recently cut lands is poorest in the South and best in the West. The position of the South is due to the very large area (128 million acres) of small private ownerships on which only one-third of recently cut lands were found to be in the upper productivity class. The commercial forest area in these small southern ownerships comprises 26 percent of all such area in the country and exceeds the entire commercial forest area of the West, the entire national ownership of the forest industries, and also of the national forests.
7. Although both clear cutting and partial cutting methods have a useful place in keeping recently cut lands productive, clear-cutting methods as now applied result in a generally lower level of productivity than do partial cuttings. Important exceptions to this general relation exist particularly in the West.
8. On 65 percent of all recently cut lands, the cutting was made primarily for large products such as saw logs, veneer logs, and piling. Only 15 percent of the area was cut primarily for products of small size such as fence posts and cordwood for pulp or fuel. Integrated utilization was practiced on the remaining 20 percent, i. e., products of both broad size classes were removed. The productivity of recently cut lands was higher where integrated utilization was practiced than where either large or small products were the primary objective of cutting. This difference in productivity is most pronounced on private lands of medium and large size, least pronounced on small private ownerships.
9. Comparison of the proportions of recently cut lands in the upper productivity class with the national average in this class identifies the following weak and strong areas in the recently cut area picture:

Type of ownership:	*Proportion of all commercial forest land on which productivity of recently cut lands is—* Below the national average (percent)	Above the national average (percent)
Private:		
Farm	31. 1	----
Other private	17. 8	3. 6
Forest industries	2. 3	7. 9
Public:		
National forest	----	13. 0
All other Federal	. 9	2. 1
State and local	. 7	4. 6
Total	52. 8	31. 2

Farm and other private forest ownerships on which recently cut lands are below the national average in productivity contain 49 percent of all commercial forest land or about 240 million acres. This area consists, for the most part, of nearly 4.5 million small private ownerships.

10. The more important conditions adversely affecting productivity of recently cut lands are—
    (a) Deficiencies in stocking on small private holdings in all sections for nearly all of the more important forest type groups, and particularly deficiencies in conditions favorable for establishment of new trees after clear cutting.
    (b) Deficiencies due to poor composition in all sections and ownerships for some of the more important forest type groups, but particularly on small private ownerships in the North. Deficient composition in the North is related to the large proportion of hardwood type groups and the wide variation in utility of the many species in such type groups.
    (c) Deficiencies due to premature cutting on small private ownerships in all sections and also on medium and large private ownerships in the North.
11. Productivity of recently cut lands varies significantly among major forest type groups. The percentage of recently cut land in the upper productivity class is below the national average for 8 of the 19 major type groups

recognized. Six of these deficient type groups are softwood or mixed softwood and hardwood groups, and of these 4 are native to the East. The area of commercial forest land occupied by the 8 deficient groups is 56 percent of all such land in the United States and Coastal Alaska. For 9 type groups, the percentage of recently cut land in the upper productivity class exceeds the national average. These include 6 of the 8 western softwood type groups, 2 eastern hardwood type groups, and western hardwoods. Together these 9 groups occupy 34 percent of all commercial forest land. Two eastern softwood type groups have productivity approximating the national average, and they occupy 10 percent of all commercial forest land.

12. The adverse conditions and deficient type groups outlined in items 10 and 11 are those tending to hold down the level of growth on recently cut lands. They identify the major opportunities which exist for increasing growth and point out where efforts may best be concentrated.

Forest
Tree
Planting

CONTENTS

FOREST TREE PLANTING

Walter M. Zillgitt

INTRODUCTION

One of the most striking features of the forest situation nationally is the extent of understocked area. More than 114 million acres, or 23 percent of the commercial forest area, is nonstocked or poorly stocked. In view of the estimates of projected demand for timber, one major problem in forestry is to get this vast understocked acreage into production and to keep it productive. Planting offers one of the most effective ways of doing this.

An attempt is made here to give a more complete appraisal of the status of forest planting and planting possibilities than has been presented in past national appraisals. Even so, attention is confined to just one part of the planting problem, i. e., "plantable area" as later defined. It is therefore recognized that as a consequence the planting estimates are conservative. If all of the planting were included that probably will be necessary to meet the estimates of projected demand, total planting possibilities and needs would be substantially greater.

Another feature of the planting situation not covered in this discussion is planting that will be done under the Soil Bank program of the Agricultural Act of 1956. Enacted between the assembling of information in 1952 and the final preparation of this report, the act provides, among other things, for converting nonforest land to forest land under a long-range conservation reserve program.

Planting needs on forest lands in the United States fall logically into three categories: (1) The planting of nonstocked and poorly stocked forest land. For the most part, this represents a huge backlog of plantable area that has accumulated over many years. It is the main source of "plantable area," as later defined and used in this analysis. (2) The planting of medium-stocked land on which stocking should be improved by artificial means, and (3) planting in lieu of natural regeneration after cutting. Categories (2) and (3) are not considered in this report, and planting on noncommercial forest land is discussed on page 284.

OBJECTIVES AND PROCEDURES OF THE PLANTING APPRAISAL

The planting phase [44] of the Timber Resource Review was designed to determine (1) the accomplishments in planting up to 1953, including the acreage of plantations in existence in 1952 and the success of past planting effort; (2) the area of nonstocked or poorly stocked forest land that would lend itself readily to planting; and (3) trends in artificial restocking.

In analyzing and interpreting available data, the national picture was brought into focus, regional differences were noted, and comparisons were made between broad classes of ownership. Possible future developments were suggested in the light of the present situation. They are, of course, speculative. However, reasonable projections based on the past should give some idea of what lies ahead.

The estimates of past planting accomplishments, area available for planting, and planting trends represent the best information available from numerous sources. Data from the Forest Survey, past reports of State Foresters, existing planting surveys in some States, and material from other agencies were consolidated into State and regional estimates. These estimates were in turn checked by the Forest Service with the aid of forestry personnel from many States. Adjustments were made on the basis of knowledge of the local situation. No on-the-ground field sampling of plantations was undertaken.

Definitions of certain key terms and an explanation of concepts basic to this discussion follow:

Plantable area.—Nonstocked or poorly stocked forest land or nonforest land on which, judged by 1952 conditions: (1) the establishment of forest tree cover is desirable and practical, and (2) regeneration will not occur naturally within a

[44] Since planting is of only minor consequence in Coastal Alaska, this discussion is confined to the continental United States.

reasonable time.[45] Plantable area includes virtually all of the nonstocked forest land. It also includes certain areas of seedlings and saplings, slightly in excess of 10 percent stocked, where local experience and judgment indicated they were practical to plant. In the case of California, lands up to 20 percent stocked in all classes (including sawtimber) were considered. The nonforest category generally pertains to former timberland diverted to cropland but which now lies idle.

All components of plantable area, including the nonforest category, are hereafter referred to as plantable commercial forest land. This analysis does not attempt to incorporate business aspects, nor does it suggest that it is economically feasible to plant all plantable area.

Natural reduction in plantable area.—The gradual decrease in plantable area through natural seeding. As used in this discussion, it is a net reduction, with accretions to nonstocked or poorly stocked land taken into account.

Planting.—The establishment of a tree cover (and/or a shrub cover in the case of shelterbelts) by the planting of nursery stock or by direct seeding.

Acceptable plantation.—For a plantation to be classed as acceptable, it was required to have at the end of the fifth year after planting at least the following number of planted trees per plantation acre:[46] Engelmann spruce and lodgepole pine, 300; other western species, 200; all eastern species, 400. These standards represent the absolute minimum; most acceptable plantations have more trees per acre after 5 years. Younger plantations were judged acceptable if they appeared likely to meet the stocking requirement 5 years after planting.

Planting success.—The area of acceptable plantations divided by the total area planted. For example, with 1,000,000 acres planted in a given area and 750,000 acres in acceptable plantations at time of the 1952 estimate, the success would be 75 percent.

[45] For purposes of this study, "a reasonable time" means that poorly stocked seedling and sapling areas in the eastern types and coastal conifer types in the West should not be left in an understocked condition for more than 5 years, and interior western types for more than 10 years.

[46] The numbers of trees presented here were adopted as minimum standards that would qualify a planted area as "acceptable." Although the standards exceed the numbers of trees required for full stocking at maturity, they should not be construed as goals for highly productive planted stands. Such minimum standards provide limited opportunity for future intermediate cuttings or thinnings and may not produce as good quality wood as more heavily stocked plantations.

STATUS OF PLANTING ON COMMERCIAL FOREST LAND

PAST ACCOMPLISHMENTS IN PLANTING

Planting began early in the history of this country, probably soon after the first land clearing. There are records of oak plantings for the production of ship's timbers in the 1740's. It is known that several hundred acres of plantations were established in eastern Massachusetts in the 1840's.

Reforestation efforts by private owners and Government agencies gradually built up over the years. It is estimated that 352,000 acres of acceptable plantations had been established on commercial forest land by 1926. Undoubtedly a much greater acreage was actually planted than this figure suggests, because early planting was attempted with little knowledge or experience and success was uncertain.

Increasing interest in planting led in 1924 to the inclusion of a provision for cooperative tree distribution in the Clarke-McNary Act. The first trees were distributed under this law in 1926, and organized reforestation efforts became widespread. Systematic planting records for the Nation as a whole also had their beginning in 1926, as a result of the reporting system necessary to administer the Clarke-McNary Act.

Area of Acceptable Plantations Low Nationally

The total planting on commercial forest land in the United States had reached 6.9 million acres by 1952. Of this total 5.2 million acres were considered acceptable (table 156).[47] The acceptable plantations are composed largely of coniferous species. The hardwoods are more difficult to outplant successfully and have not been planted anywhere near as extensively as conifers.

The 5.2 million acres of acceptable plantations established by 1952 appear at first glance rather an impressive accomplishment. However, as will be shown later, in relation to the total area awaiting planting it represents only a modest beginning.

North Leads in Area of Acceptable Plantations

The area of acceptable plantations is about equally divided between the North and the rest

[47] Area of acceptable plantations and plantable area by States and ownership classes are given in appendix tables 18 and 19.

of the country (table 156). The North leads with 51 percent, the South is next with 38 percent, and the West last with 11 percent.

Among the regions, the Lake States is first with 27 percent of the national total, while the Southeastern region is close behind with 23 percent. Other leading regions are the Middle Atlantic with 15 percent, West Gulf with 10 percent, and Pacific Northwest with 7 percent.

Area of Acceptable Plantations About Equally Divided Between Public and Private Ownerships

About 48 percent of acceptable plantations are on private lands; 52 percent are on public ownerships (table 157 and fig. 86). The percentage in public ownership is distributed 30 percent on Federal and 22 percent on State and other public holdings.

National-forest acceptable plantations make up most of the Federal total, with 27 out of 30 percent. They comprise over one-fourth of all acceptable plantations in the United States. The States have 17 percent of the national total and the local units of government 5 percent.

The ownership of acceptable plantations by sections is distributed fairly equally in the North between Federal, local public, and private, with local public holding a slight lead; in the South it is primarily private; and in the West predominantly Federal.

Planting Success Highest in South

Early attempts at planting in the United States were beset with serious difficulties. Besides the natural hazards, little knowledge of artificial regeneration was available either from experience or research. Failures were frequent at the outset, but as planting continued better understanding and better techniques were developed. The success for all past planting in the Nation as a whole is 76 percent (table 158).

Sectionally, the South leads the North and West with a success of 85 percent, as against 71 percent and 75 percent, respectively. Among the chief reasons for the better showing of the southern sec-

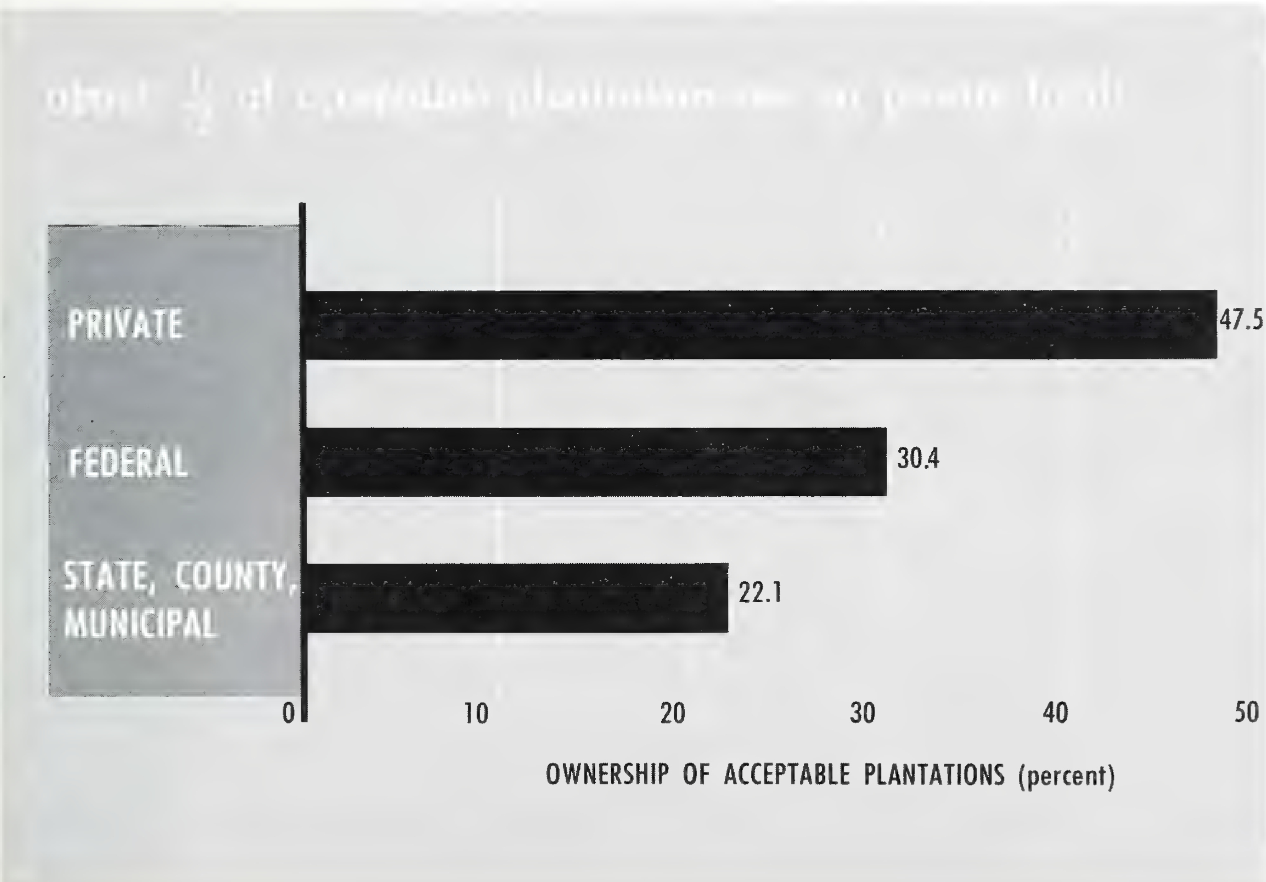

Figure 86

TABLE 156.—*Commercial forest area, plantable area, and acceptable plantations on commercial forest land, by section and region, continental United States, 1952*

Section and region	Total commercial forest area	Plantable area		Area of acceptable plantations up to and including 1952		Acceptable plantations established in 1952: Total area	Acceptable plantations established in 1952: Proportion of plantable area
	Thousand acres	*Thousand acres*	*Percent*	*Thousand acres*	*Percent*	*Thousand acres*	*Percent*
North:							
New England	30, 658	1, 228	2. 4	159	3. 0	4	0. 3
Middle Atlantic	42, 225	3, 725	7. 2	780	15. 0	45	1. 2
Lake States	53, 272	7, 651	14. 7	1, 391	26. 7	47	. 6
Central	42, 394	7, 869	15. 1	283	5. 4	30	. 4
Plains	5, 492	975	1. 9	56	1. 1	1	. 1
Total	174, 041	21, 448	41. 3	2, 669	51. 2	127	. 6
South:							
South Atlantic	46, 152	4, 081	7. 8	300	5. 8	30	. 7
Southeast	94, 985	14, 214	27. 4	1, 182	22. 7	125	. 9
West Gulf	52, 151	3, 652	7. 0	495	9. 5	58	1. 6
Total	193, 288	21, 947	42. 2	1, 977	38. 0	213	1. 0
West:							
Pacific Northwest	45, 365	2, 468	4. 8	376	7. 2	53	2. 1
California	17, 317	4, 104	7. 9	26	. 5	4	. 1
Northern Rocky Mountain	33, 840	1, 169	2. 2	115	2. 2	2	. 2
Southern Rocky Mountain	20, 489	812	1. 6	47	. 9	1	. 1
Total	117, 011	8, 553	16. 5	564	10. 8	60	. 7
Total, United States	484, 340	51, 948	100. 0	5, 210	100. 0	400	. 8

TABLE 157.—*Commercial forest area, plantable area, and acceptable plantations on commercial forest land, by type of ownership, continental United States, 1952*

Ownership	Total commercial forest area	Plantable area		Area of acceptable plantations up to and including 1952		Acceptable plantations established in 1952: Total area	Acceptable plantations established in 1952: Proportion of plantable area
	Thousand acres	*Thousand acres*	*Percent*	*Thousand acres*	*Percent*	*Thousand acres*	*Percent*
Federal:							
National forest	81, 314	4, 567	8. 8	1, 419	27. 2	39	0. 9
Bureau of Land Management	5, 513	247	. 5	14	. 3		
Indian	6, 945	210	. 4	12	. 2	[1] 3	[1] . 3
Other Federal	5, 102	593	1. 1	141	2. 7		
Total	98, 874	5, 617	10. 8	1, 586	30. 4	42	. 7
Other public:							
State	19, 169	1, 439	2. 8	900	17. 3	41	2. 8
County and municipal	8, 047	1, 196	2. 3	250	4. 8	11	. 9
Total	27, 216	2, 635	5. 1	1, 150	22. 1	52	2. 0
Private	358, 250	43, 696	84. 1	2, 474	47. 5	306	. 7
All ownerships	484, 340	51, 948	100. 0	5, 210	100. 0	400	. 8

[1] Data by type of ownership not available.

tion are (1) its later entrance on the planting scene, enabling it to profit from experience accumulated in the North, (2) favorable climate, (3) productive soils, and (4) superior planting species. The West has gained its near average success largely because of the 90-percent success for the Pacific Northwest, the most successful of the regions.

The Pacific Northwest, Southeast, South Atlantic, West Gulf, and Lake States Regions all exceed the national rating of 76 percent. California and the Southern Rocky Mountain Regions stand out as the chief problem areas with only 31 percent and 55 percent planting success, respectively. Natural obstacles to planting are very severe in these regions and will be difficult to overcome.

State and local governments appear to have had somewhat more planting success than either the Federal Government or private ownerships. However, the minor differences are probably more apparent than real, when variations in planting difficulty and site are taken into account.

Plantable Area, 1952

Plantable area has accumulated from several sources. Among the more important ones are (1) fire alone, (2) logging followed by fire, and (3) the abandonment of agricultural land. Insects, disease, animals, poor cutting practices, overgrazing, and hurricanes and other catastrophes have also contributed extensive areas in need of reforesting. Although widespread and in varying condition, practically all such lands can be put back into production within a reasonable period only by planting.

Plantable Area Large Nationally

There are 51.9 million acres of plantable commercial forest land in the United States (table 156). It constitutes about 11 percent of the total area of commercial forest lands. The significance of this large area of timberland has already been pointed out. It has a high potential for growing timber; it will lend itself to planting. Much of this area should be restored to a higher level of productivity with as little delay as possible.

East Has Greatest Share of Plantable Area

Nearly 84 percent of the plantable commercial forest land is located in the eastern half of the United States. The acreage is quite evenly divided between North and South; 21.4 million

Table 158.—*Success of past planting on commercial forest land, by section and region, and by ownership class, continental United States, 1952*

Section and region	Federal			Other public			Private	All ownerships
	National forest	Other	Total	State	County and municipal	Total		
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
North:								
New England	67	(1)	75	69	67	68	57	62
Middle Atlantic	84		84	76	77	76	51	63
Lake States	73	74	73	88	86	88	78	79
Central	84	67	83	73	58	70	60	68
Plains	53		53	50		50	69	63
Total	74	72	74	80	80	80	60	71
South:								
South Atlantic	96	73	84	81	67	79	81	82
Southeast	95	82	90	87	(1)	88	86	87
West Gulf	76	65	75	83	(1)	91	84	81
Total	87	78	84	85	92	86	85	85
West:								
Pacific Northwest	91	87	90	90	83	90	90	90
California	35		35				24	31
Northern Rocky Mountain	70	(1)	70	(1)		(1)		70
Southern Rocky Mountain	55	56	55				50	55
Total	71	79	72	91	83	90	76	75
All regions	76	78	76	81	80	81	74	76

[1] Percentages were not computed for areas totaling less than 1,000 acres.

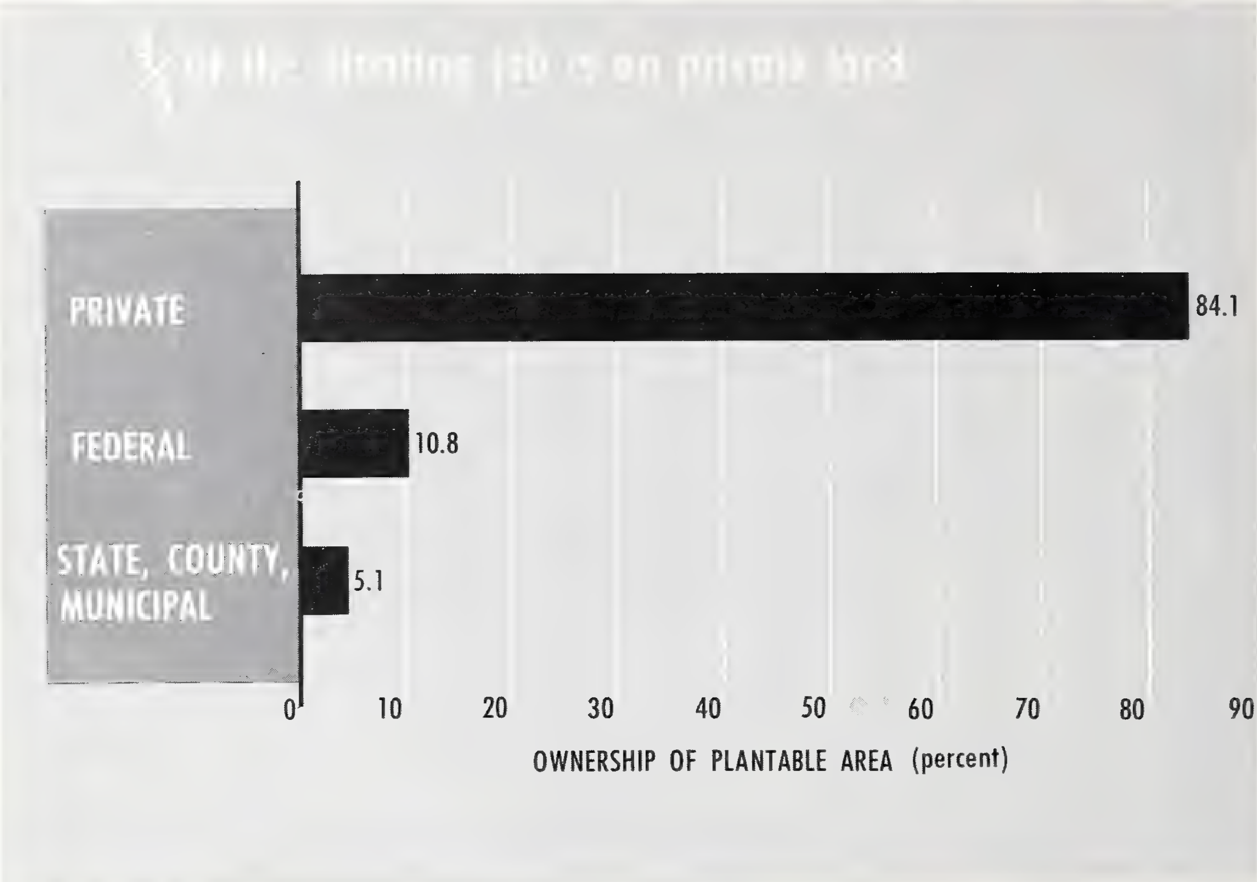

Figure 87

acres in one case—21.9 million acres in the other (table 156).

Among the regions, the Southeast stands out with more than one-fourth of the national plantable area. The Southeast, Central, and Lake States collectively contain 57 percent of all plantable area. Two other regions, California and South Atlantic, each have plantable area in excess of 4 million acres.

In ratio of plantable area to commercial forest area, California leads the regions with 24 percent (table 156). Other regions which are high in this regard are Central, 19 percent; Plains, 18 percent; Southeast, 15 percent; and Lake States, 14 percent.

The States with the largest plantable areas are California, Florida, Mississippi, Illinois, Michigan, Minnesota, and Wisconsin, each with 2 million acres or more (see appendix table, p. 542). Their combined plantable area is about 24 million acres, or nearly half of the United States total.

Bulk of Plantable Area Is in Private Ownership

The most striking feature with regard to ownership of plantable area, nationally, is the heavy concentration (84 percent) in private ownership (table 157 and fig. 87). Only 16 percent is in public ownership. In the West, however, the 8.6 million acres of plantable area are about equally divided between private and public ownership. The proportion of commercial forest area plantable on Federal lands is much lower than on private and other public ownerships.

Plantable Area Reducing Naturally

There is another aspect of the reforestation situation which should not be overlooked. It appears that a gradual reduction in plantable area is now taking place through natural seeding. This marks a reversal of earlier trends and can be attributed primarily to better fire protection and generally improved forest-management practices.

Results of this study suggest that a net annual reduction in plantable area of 312 thousand acres on the average, through natural seeding, can be expected in the years ahead. Possible accretions to plantable area from serious fires, further abandonment of submarginal farmland, and other causes were considered in this estimate. Although in the right direction, the reduction is so slow that

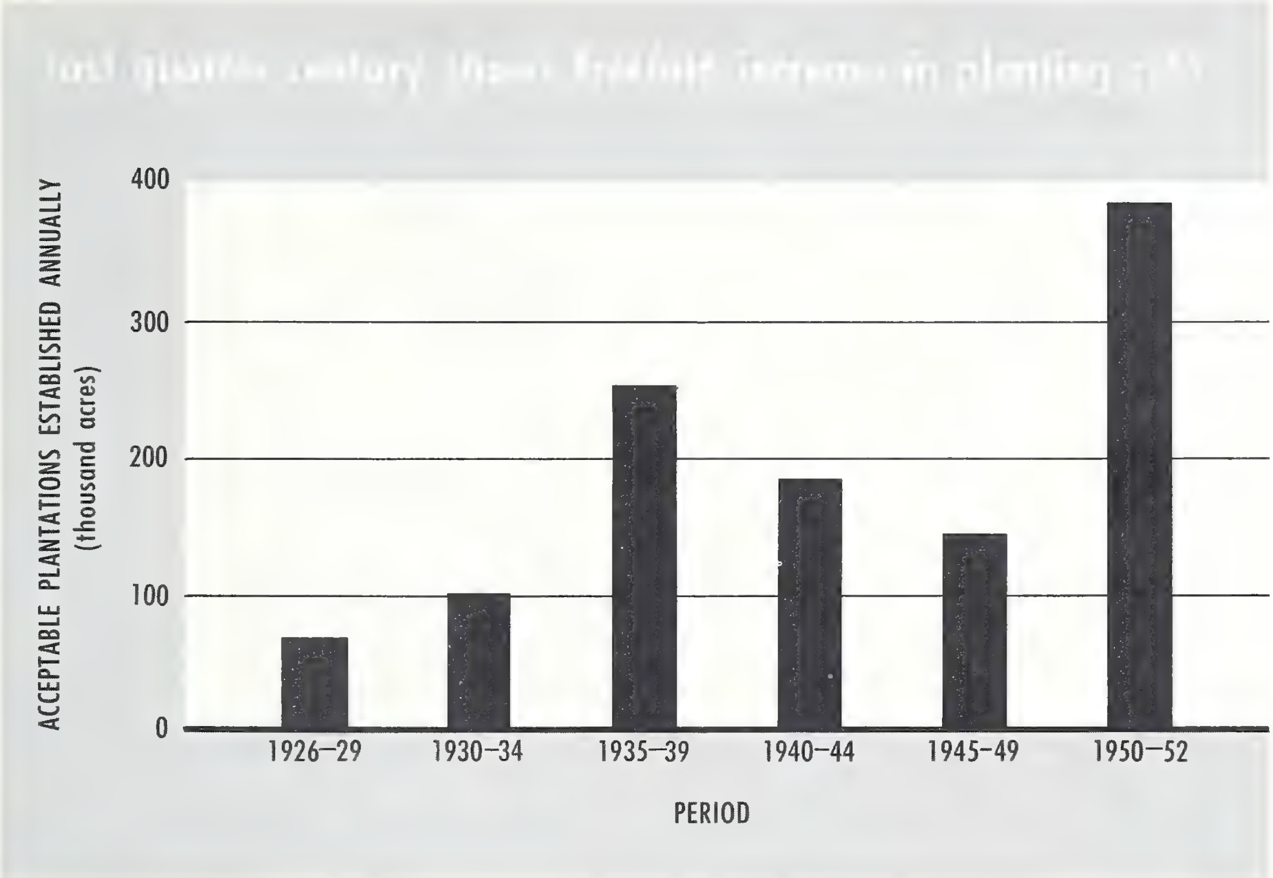

Figure 88

it fails to nullify the desirability of planting. At the rate indicated, it would take 165 years of natural restocking to eliminate plantable area. It seems obvious that restoration of these lands to productivity should be hastened by artificial means.

Planting Trends

While the present status of planting as judged by area planted in relation to total area available for planting provides little cause for comfort, an examination of trends in artificial regeneration is more encouraging. The trend toward natural reduction of plantable area has already been discussed. Planting trends and the combined effect of artificial regeneration and natural restocking still must be considered.

In preparing estimates of future planting in the United States, no attempt was made to project them beyond 1984. Plantations established after that time would be too immature by the year 2000 to influence significantly the growth projections of the Timber Resource Review.

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Rate of Planting Has Risen Sharply

In the 26-year-period 1926–52, the annual rate of planting in the United States increased over 5 times (table 159 and fig. 88). The rise was not steady, but rather was marked by two rapid spurts. During the 1930's there was a sharp increase in planting under the stimulation of the emergency conservation program. Activity fell off during the war years, but climbed rapidly again after the late 1940's. The rise in the national rate was due primarily to greatly increased planting in the South.

The cumulative total area of acceptable plantations shows the same general pattern (table 159 and fig. 89). Here, again, the more rapid accretion during the 1930's and post-war years is apparent. The acreage of acceptable planting since 1926 (4.9 million acres) is almost 14 times the 352 thousand acres of acceptable plantations established prior to 1926.

Figure 89

Planting Rate Expected To Go Still Higher

In appraising the possible future rate of planting, a number of factors were apparent which suggested a rise in the immediate future. Chief among them were new machines for planting; increasing general interest, especially by industrial groups and bankers; and better nursery stock. Opinions as to the combined effect of these factors were gathered from informed people at State and regional levels. Estimates of future planting trends, based on these opinions, are summarized in table 160; they are speculative, of course.

These estimated trends anticipate that the rate of planting will continue to increase for a couple of decades. A maximum annual rate of more than 800 thousand acres may be attained

TABLE 159.—*Area of acceptable plantations established on commercial forest land, by section and region, and by specified years, continental United States, 1926–52*

Section and region	Prior to 1926	1926–29	1930–34	1935–39	1940–44	1945–49	1950	1951	1952	Total
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
North:										
New England	40	31	28	28	14	7	3	4	4	159
Middle Atlantic	71	84	158	167	94	87	35	39	45	780
Lake States	117	75	202	480	247	137	34	52	47	1, 391
Central	35	5	5	54	53	58	17	26	30	283
Plains	23	8	7	8	4	3	1	1	1	56
Total	286	203	400	737	412	292	90	122	127	2, 669
South:										
South Atlantic	1	2	8	67	63	59	40	30	30	300
Southeast	1	4	17	258	305	222	143	107	125	1, 182
West Gulf	1	33	15	121	67	68	62	70	58	495
Total	3	39	40	446	435	349	245	207	213	1, 977
West:										
Pacific Northwest	24	16	23	42	54	75	46	43	53	376
California	1	4	5	4	4	1	1	2	4	26
Northern Rocky Mountain	27	7	31	24	12	8	2	2	2	115
Southern Rocky Mountain	11	5	7	10	5	5	2	1	1	47
Total	63	32	66	80	75	89	51	48	60	564
Total, United States	352	274	506	1, 263	922	730	386	377	400	5, 210
Annual rate	(1)	[2] 68	101	253	184	146	-------	[3] 388	-------	-------
Cumulative total	352	626	1, 132	2, 395	3, 317	4, 047	4, 433	4, 810	5, 210	5, 210

[1] Undetermined number of years.
[2] 4-year average.
[3] 3-year average.

TABLE 160.—*Anticipated area of acceptable plantations on commercial forest land, by section and specified years, continental United States, 1953–84*

Section	Plantations established prior to 1953	Anticipated future plantings				
		1953–54	1955–64	1965–74	1975–84	Total
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
North	2, 670	320	1, 850	1, 840	1, 820	8, 500
South	1, 980	760	5, 140	5, 170	4, 820	17, 870
West	560	130	880	1, 090	1, 120	3, 780
Total, United States	5, 210	1, 210	7, 870	8, 100	7, 760	30, 150
Annual rate	(1)	610	790	810	780	----------
Cumulative total	5, 210	6, 420	14, 290	22, 390	30, 150	30, 150
Cumulative total from 1953	-----------	1, 210	9, 080	17, 180	24, 940	----------

[1] Undetermined number of years.

during the period 1965–74. By 1975, the more favorable planting sites and largest blocks of plantable area will be reforested. Planting the more difficult sites will reduce the rate of planting thereafter.

The acreage of plantable area remaining in 1952 looms large in comparison with the area of acceptable plantations established by that year. It is encouraging, however, to note that the area of acceptable plantations expected during the period 1953–84 is also much greater than the area successfully planted by 1952 (fig. 90). We can at least expect considerably better planting progress in the future than in the past. If present indications hold, the area of acceptable plantations may reach 30 million acres by 1984.

Comparison With Reappraisal Estimates

An earlier study of the forest situation in the United States was made by the Forest Service during 1945 and 1946. It was reported in the publication "Forests and National Prosperity," but is commonly referred to as the "Reappraisal." [48] The brief general treatment of the planting situation at that time contains few statistics. In only one case is there a comparable figure in the Timber Resource Review, as shown in the following tabulation.

[48] FORESTS AND NATIONAL PROSPERITY. A REAPPRAISAL OF THE FOREST SITUATION IN THE UNITED STATES. U. S. Dept. Agr. Misc. Pub. 668. 1948.

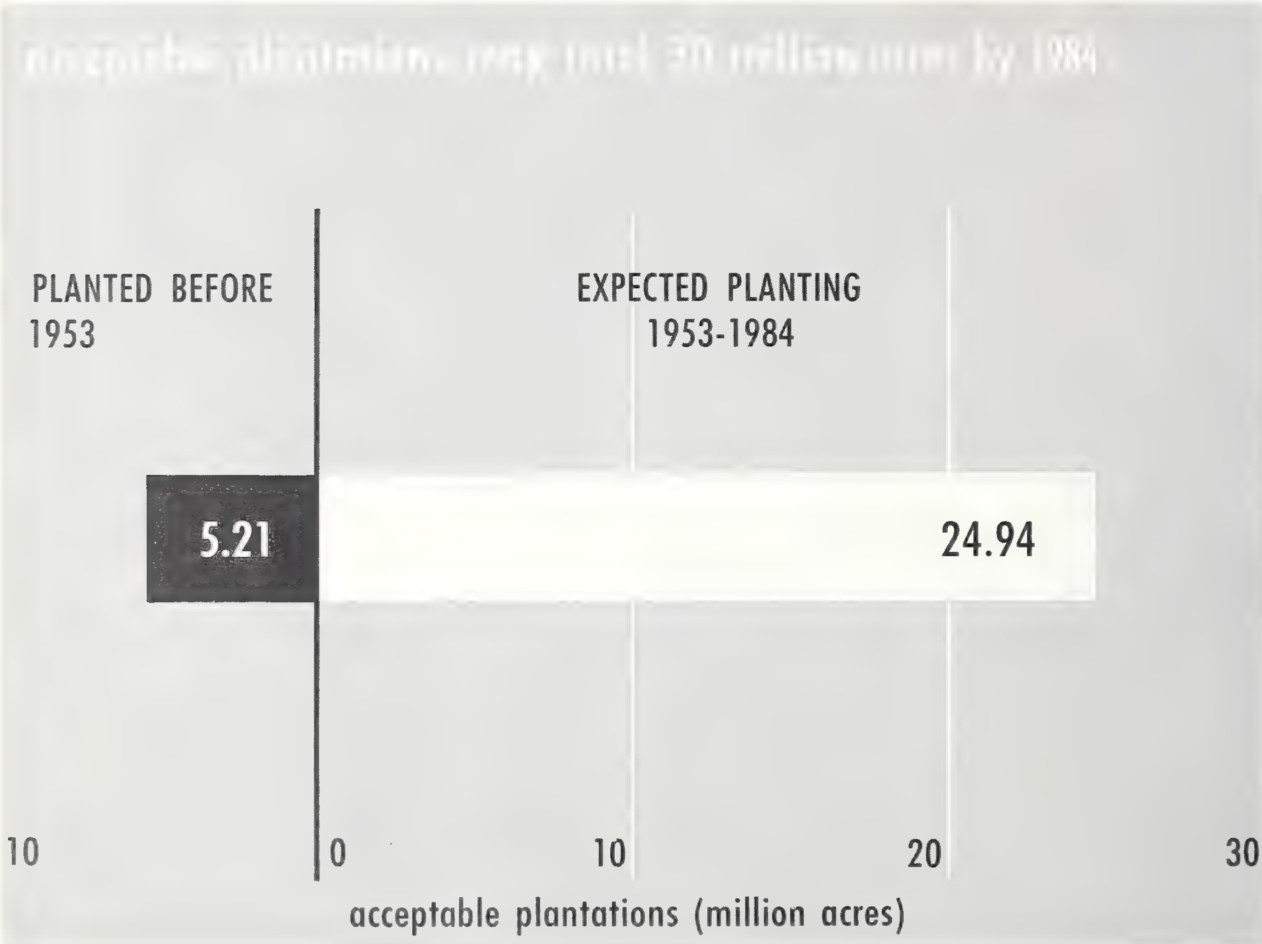

Figure 90

Item:	Reappraisal estimate, 1945 (million acres)	Timber Resource Review estimate, 1952 (million acres)
Poorly stocked seedling and sapling stands plus nonstocked commercial forest land	75.3	68.9
Forest area planted on commercial and noncommercial forest land	5.0	----------
Forest land planted, commercial only	----------	6.9
Area of acceptable plantations on commercial forest land	----------	5.2
Net area needing planting, commercial forest land	67.0	----------
Plantable area on commercial forest land	----------	51.9
Expectation of possible future planting on commercial forest land	30.0 to 35.0	----------
Area of acceptable plantations on commercial forest land anticipated by 1984	----------	30.2
Area that would profit from interplanting	23.0	----------

The estimate of poorly stocked and nonstocked commercial forest land of 68.9 million acres in 1952 represents a difference of 6.4 million acres from the 1945 estimate of 75.3 million acres. It is questionable if the establishment of acceptable plantings and natural restocking over the 7-year period account for all of the difference. Some of it may be due to variations in the definitions and procedures employed in the two studies.

Other figures in the two studies are not comparable, although treating somewhat similar phases of the planting problem. For example, the 67.0 million acres estimated as needing planting in the Reappraisal includes lands which might not be physically practical to plant, while doubtful lands are excluded from the 51.9 million acres of plantable area in the current review. Similarly, other estimates in the two studies are not comparable without careful adjustment and interpretation.

A Long Way To Go

Two existing trends that act to reduce the large plantable area in this country have been discussed. One is the natural reduction which tends to become greater as forest lands receive better protection. Eventually, over a very long period, natural restocking alone would restore much of the plantable area to some measure of productivity. Obviously, it would be impractical to do nothing but let nature take its course. The second trend which serves to reduce plantable area is the increasing total of acceptable plantations.

By way of summary at this point, it is interesting to speculate where the combined action of these two trends might leave the planting situation in 1984 (fig. 91). Although the reduction in plantable area would be very great, more than 17 million acres would still remain to be reforested—the most difficult acres. Furthermore, this assumes that no catastrophes of nature or man will upset the anticipated pattern.

Although future trends presented here are speculative, they are based on developments in the past and an understanding of the present situation. If present trends continue as outlined, and if no unforeseen difficulties arise, most of the plantable area will be reforested by the turn of the century. Developments such as faster growing species with pest resistance and knowledge of how to plant the more difficult sites would help immeasurably.

Despite the rather strong indications that in future years the planting situation will brighten considerably, one feature overshadows all others. That is the immensity of the task as shown by the relationship of acceptable plantations established in 1952 to plantable area (table 156). Nationally, the acreage of acceptable plantations established in 1952 was only 0.8 of 1 percent of plantable area, and the rate is low in all sections and regions. We still have a long way to go.

The rate at which acceptable plantations were established in 1952 is uniformly low for all types of ownership (table 157 and fig. 92). On private ownerships which have 84 percent of plantable area and on Federal ownerships, the rate was only 0.7 of 1 percent of plantable area. On State and other public ownerships, acceptable plantations established in 1952 amounted to 2.0 percent of the plantable area.

Planting progress may be summed up in this way: 5.2 million acres of acceptable plantations established up to and including 1952, and 400 thousand acres of acceptable plantations established in 1952, as compared to the 51.9 million acres of plantable area remaining (fig. 93). The advance so far has been too slow in view of the projected demands for timber and the need to get presently understocked areas into production and to keep them producing.

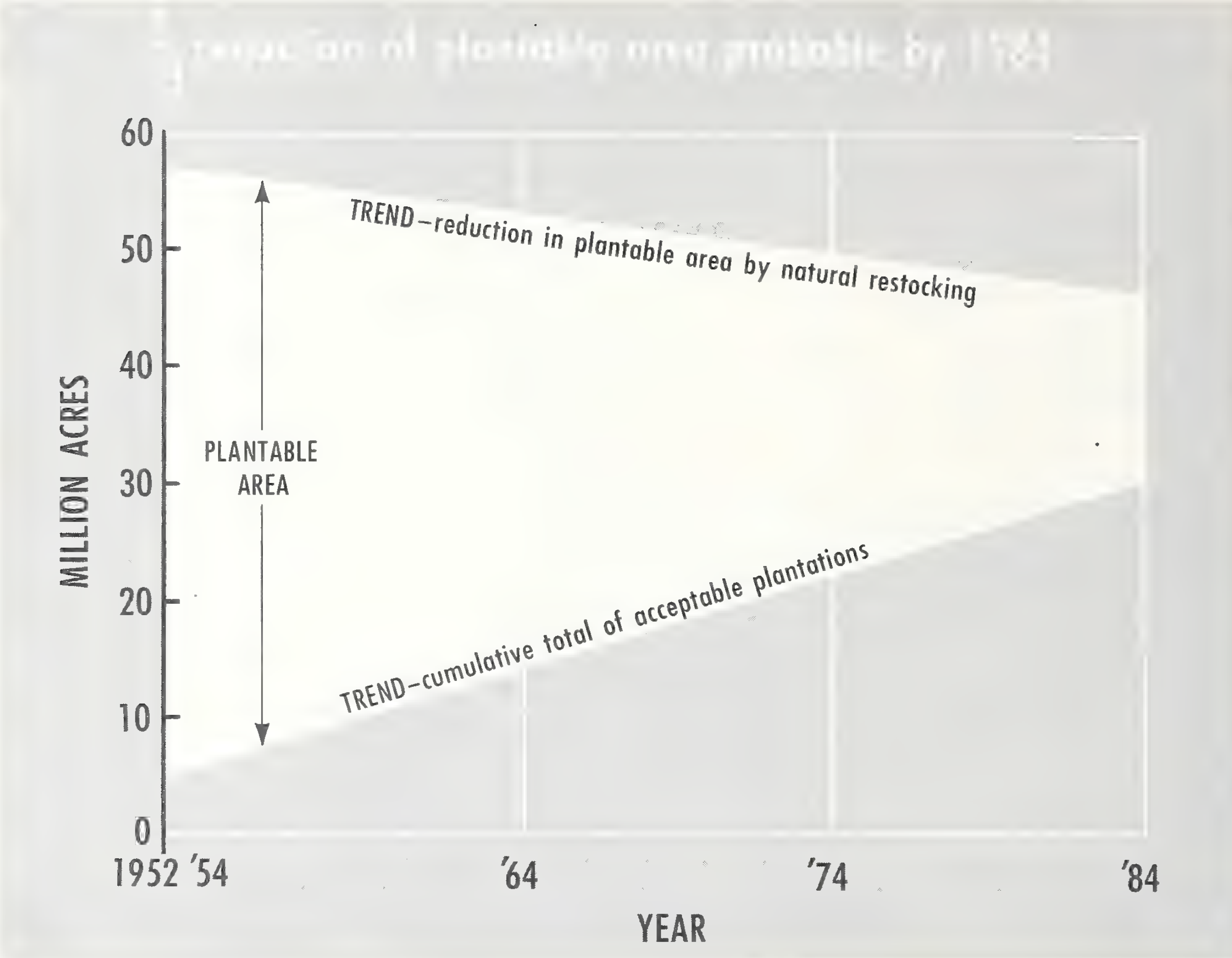

Figure 91

Planting Noncommercial Forest Land and Shelterbelts

In addition to plantations on commercial forest land which will eventually be harvested for forest products, there are desirable noncommercial plantings primarily valuable for some purpose other than timber yields. Plantings for flood control and watershed protection, wildlife habitat, and aesthetic purposes, and plantings on parks, restricted military reservations, and other areas where land-use policies make harvest cutting unlikely, are in this category.

The practice of planting trees as shelterbelts to protect buildings and crops has been employed in the United States for many years. Early settlers in the prairie States planted shelterbelts on a large scale, but the most noteworthy effort in this line was the Prairie States Forestry Project during the 1930's. Nearly 223 million trees were planted on private land in the Plains Region under that program.

Acceptable Plantations on Noncommercial Forest Land

Acceptable plantations on noncommercial forest land in the United States totaled 96 thousand acres in 1952 (table 161). Of this total 92 percent was in the North, with the balance (8 percent) in the West. State and private ownerships together had 74 percent of the acceptable plantations, while the States alone had 44 percent.

Planting success was spotty, with survival varying all the way from 90 percent in New York to 10 percent in California. The national score was 96 thousand acres of acceptable plantations out of 168 thousand acres planted, or a success of 57 percent.

Area of Plantable Noncommercial Forest Land

The total area of plantable noncommercial forest land in the United States is estimated at 5.4 million acres (table 162). The West has 72 per-

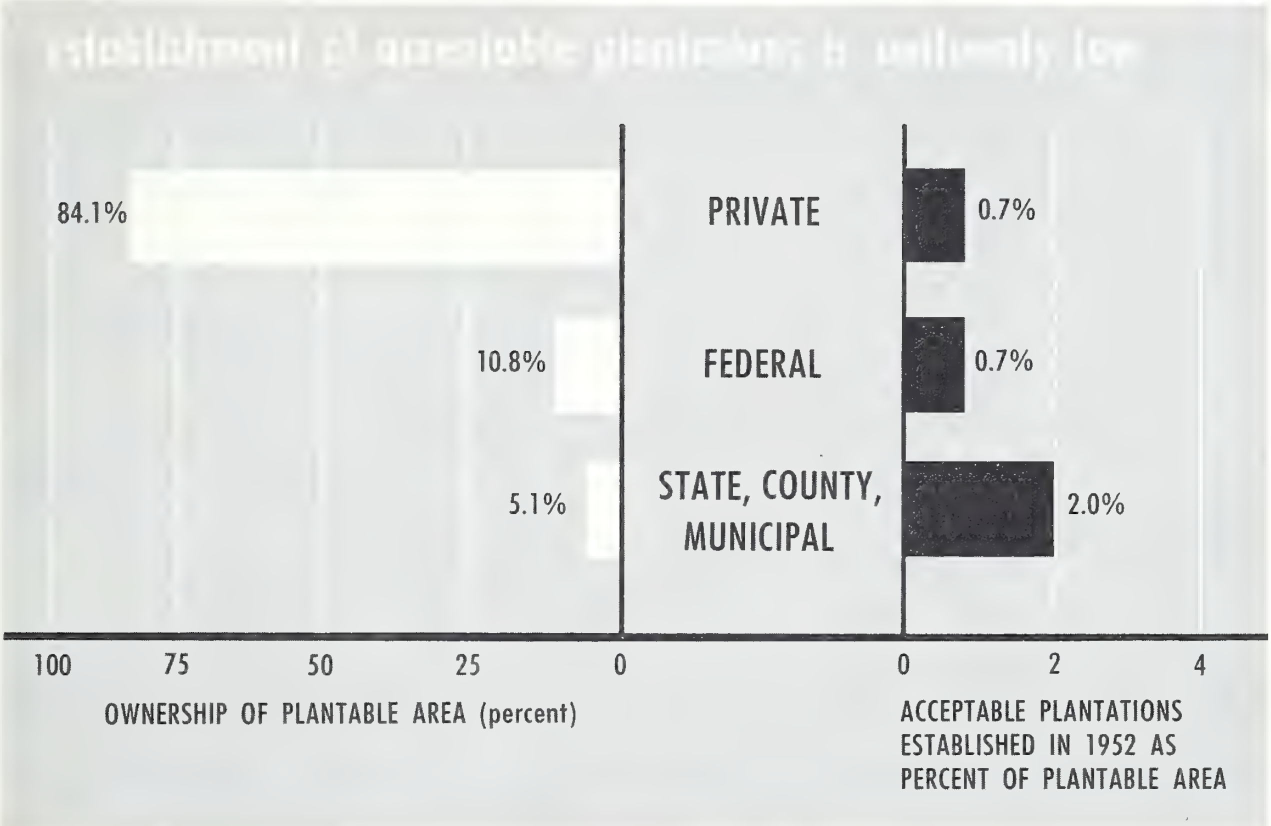

Figure 92

TABLE 161.—*Acceptable plantations on noncommercial forest land, by section and type of ownership, continental United States, 1952* [1]

Ownership class	North	South	West	Total, United States
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*
Federal:				
Bureau of Land Management			[2] 0. 3	0. 3
Indian			[2] . 3	. 3
Other Federal	15		[2] . 1	15
Total	15		1	16
Other public:				
State	42			42
County and municipal	9			9
Total	51			51
Private	22		7	29
All ownerships	88		8	96

[1] Shelterbelts not included.
[2] Although these acreages are small individually, they round off in total to 1,000 acres.

TABLE 162.—*Area of plantable noncommercial forest land, by section and type of ownership, continental United States, 1952* [1]

Ownership	North	South	West	Total, United States
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*
Federal:				
National forest	55		1, 333	1, 388
Bureau of Land Management	1		1, 020	1, 021
Indian			50	50
Other Federal	2		29	31
Total	58		2, 432	2, 490
Other public:				
State	169		107	276
County and municipal	186		2	188
Total	355		109	464
Private	1, 093		1, 400	2, 493
All ownerships	1, 506		3, 941	5, 447

[1] Excludes shelterbelts.

Figure 93

cent of such lands, with the rest all in the North. Nearly one-half of it is in private ownership; about one-fourth is national-forest land; and the rest is in other Federal, State, and local ownerships.

About 20 percent of the area of plantable noncommercial forest land should be devoted to watershed protection and improvement. The bulk of the remainder needs wildlife habitat improvement.

Shelterbelt Planting

Shelterbelts established and still in existence in 1952 totaled 589 thousand acres, and were largely concentrated in the Plains Region of the North. Public ownership is rare for virtually all such plantings are on private land.

Additional shelterbelts are desirable, and there will very likely be more of this planting in the future. They may ultimately approach 3 million acres. Almost all of this increase will be on private lands.

PLANTING HIGHLIGHTS

(1) *Main planting job still lies ahead.* The task of reclaiming idle forest land in the United States by artificial regeneration has merely started. Acceptable plantations cover only 5 million acres as of 1952. There is an additional 52 million acres of plantable area, which is equivalent to 11 percent of all commercial forest land. Nearly 84 percent of plantable area is located in the eastern half of the United States and is almost evenly divided between North and South.

(2) *Bulk of plantable area is in private ownership.* Only 16 percent of plantable area is in public ownership as compared to 84 percent in private ownership.

(3) *Plantable area can add substantially to timber supplies.* The full significance of the potential benefits from restoring idle lands to production by artificial restocking cannot be appraised fully without looking ahead many years. Maximum values from current planting will not be realized until after the year 2000. By that time, trees measured now in numbers of planting stock will be measured in board-feet of lumber and cords of pulpwood. If the 52 million acres of plantable area were producing at a rate of 150 board-feet of net growth per acre per year, they would add about 8 billion board-feet annually to timber supplies.

(4) *Planting trend is upward.* The annual rate of planting increased from 68 thousand acres in 1926–29 to 388 thousand in 1950–52, and it is expected to go higher. From the 1952 total of 400,000 acres planted acceptably, the rate may rise to a maximum of more than 800 thousand acres during the period 1965–74. Because of increased planting and a natural reduction in plantable area, most of the present plantable area may be reforested by the turn of the century. However, even with the upward trend in planting, much of the plantable area will not be planted in time to contribute to our sawtimber supplies by the year 2000.

(5) *Planting estimates are conservative.* Impressive as they may be, the estimates given here for plantable area present only a part of the planting picture. The parts not presented, primarily the planting of medium-stocked lands on which stocking should be improved by artificial regeneration and planting instead of waiting for natural regeneration after cutting, are vitally important, too, if we are to meet the timber demands of the future. If all planting had been included, total planting possibilities and needs would be substantially greater than the estimates in this appraisal.

Ownership of Forest Land and Timber

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CONTENTS

OWNERSHIP OF FOREST LAND AND TIMBER

H. R. Josephson
John R. McGuire

INTRODUCTION

The condition of forest lands and prospective timber growth depend to a great extent upon the decisions of several million individuals, corporations, and public owners of forest lands. Ownership thus represents one of the key factors affecting the Nation's timber supply. As primary dependence is placed upon the growing of new timber crops, the attitudes of forest owners, their capacity for management, and their response to forestry programs become of increasing importance in developing forest policies and action programs.

Field surveys show that forest productivity, planting, fire protection, and other management practices are directly related to type of ownership and size of forest holdings. They are related to owners' financial capacity and interests in timber growing. Programs for American forestry, if they are to be successful, must reach a great variety of owners, particularly the vast number of private owners who control the bulk of the Nation's forest land.

THE INFLUENCE OF PUBLIC LAND POLICIES

Current problems of forest ownership to a large degree have their roots in ownership patterns and land policies followed at various stages of the Nation's history.

Origin of the Public Domain

In the original 13 States and Texas, a land area of about 460 million acres was held in private and State grants. But with the subsequent growth of the United States, the Federal Government acquired title to unoccupied or public domain lands totaling 1,442 million acres in the continental United States alone. This vast area was obtained from the original 13 States during the period 1781–1802, from France in 1803, from Spain in 1819, from Mexico in 1848 and 1853, from Texas in 1850, from Indian tribes through various treaties and purchases, and by occupation of the Oregon territory. Acquisition of Alaska from Russia in 1867 added an additional 365 million acres of land to the Federal public domain. A portion of the public domain in the United States was transferred to individuals or States to satisfy prior claims, but most of it was made subject to disposal under a wide variety of public land laws.

Lands Transferred to Private and State Ownership

The historical policy of the United States with respect to the public domain provided that the Federal Government act as trustee, with lands to be transferred to private ownership as rapidly as practicable. This policy was designed to aid in the development of agriculture, education, transportation, and communications, to foster economic growth in the new western territories, and to strengthen the national economy.

In carrying out this policy, the Federal Government has disposed of more than 1 billion acres of public domain in the United States, or 70 percent of the area once held there. This has been achieved primarily through public and private land sales; homestead grants and sales; grants to States for schools, internal improvements, and various institutions; grants to railroad corporations; grants to veterans; mineral entries; and sales under the Timber and Stone, Timber Culture, and desert land laws.

The Federal Government largely succeeded in its objective of fostering the settlement and rapid development of a vast wilderness. In general, the most productive and accessible timberlands were disposed of to a variety of individual, railroad and other corporate, and State ownerships. As a result of the procedures followed, many areas of timber and other land in the West were disposed of in tracts that were too small for efficient management, and much forest land was transferred to speculators and other owners through fraud and lenient public land laws.

Public Domain Reserved for National Values

From time to time, the Federal Government provided for retention of public-domain lands in Federal ownership to meet certain paramount national needs. In the first major conservation action in 1891, Congress provided for the establishment of forest reserves, later to be known as national forests, to protect the timber and water resources on important parts of the remaining public domain. At various times, other withdrawals were made for national purposes, including Indian reservations, military reserves, national parks, reclamation and flood-control areas, and wildlife refuges.

About 230 million acres of land in the continental United States, or 16 percent of the original public domain, has thus been reserved by the Federal Government for specific public uses. This includes 134 million acres in the national forests, 54 million acres held in trust for Indians, and 41 million acres in holdings administered by various other Federal agencies. In Alaska, about 21 million acres of public domain has been designated for national forests, 32 million acres for military reserves, and 19 million acres for other public uses.

Nearly a third of the 230 million acres of public-domain lands retained for public use in the continental United States is classed as commercial forest land. Somewhat more than a quarter of the total is noncommercial forest with high public value for watersheds, recreation, hunting, and fishing. The balance is principally range, alpine, or desert lands.

Large Areas of Vacant Public Domain Remain

There also remains in the continental United States about 171 million acres of vacant, unappropriated, and unreserved public domain under the administration of the Bureau of Land Management. About 162 million acres are in Taylor Grazing Districts or are leased for grazing. These remnant, vacant, public-domain lands that have neither been specifically reserved for national purposes nor disposed of under the various land-disposal laws represent about 12 percent of the original public domain.

With the exception of scattered forest and woodland, these lands consist mainly of desert, semidesert, and rough mountainous areas that have remained in Federal ownership largely because of their limited commercial value for private ownership. Most of Alaska—about 290 million acres—also is still vacant and unappropriated public domain.

Some Land Reacquired by Federal Government

Long-term trends in Federal holdings show a continuing net movement of land out of Federal ownership, although during the depression years of the 1930's and World War II acquisitions exceeded disposals. From time to time, land has been purchased or acquired through exchanges or donations for national forests, national parks, military reservations, game refuges, reclamation, flood control, development of power and atomic energy, and other public purposes. During the years of the great depression, certain areas of submarginal farmland also were purchased by the Federal Government as part of a program of land conservation and utilization.

At the end of 1953, such acquired lands totaled about 58 million acres, including 46 million acres obtained by purchase and 12 million largely by exchanges and donations. These acquired lands represent about 13 percent of the 459 million acres of land owned or administered by the Federal Government in the continental United States.

Federal disposals of public domain and acquisitions of land over the years may be summarized as follows:

	United States (million acres)	*Alaska (million acres)*
Original public domain	1, 442	365
Disposals	1, 041	3
Reserved for public purposes	230	72
Vacant and unappropriated	171	290
Purchases and other acquisitions	58	---
Total owned or administered by the Federal Government	459	362

State and Local Public Land Policies Vary

The area of public domain granted by the Federal Government or reserved to the States totaled about 232 million acres. Most of these lands were later transferred to private ownership. In 1950, State land holdings included only about 52 million acres of grants from the public domain, plus about 28 million acres acquired largely through tax delinquency. Much of the present State land is in scattered holdings suitable chiefly for range use, but roughly a fourth of the total is classed as commercial forest land.

County and other local governments also have acquired fairly large areas of rural land, chiefly through tax delinquency, including about 8 million acres of commercial forest land.

Many of the State and local public land holdings are managed for such purposes as forests, parks,

and game refuges or management areas, or are leased for grazing purposes. Some areas are without designated uses or development policies and some are available for sale.

THE PRESENT PATTERN OF COMMERCIAL FOREST LAND OWNERSHIP [49]

Nearly Three-Fourths of Forest Land Is Privately Owned

Largely as a result of past land policies that have favored small-scale, fee-simple ownership, about 358 million acres, or 73 percent of the Nation's commercial forest land, is in private holdings (table 163 and fig. 94). Farm holdings represent the largest class of ownership, with 34 percent of the commercial forest land. Forest industries own 13 percent. A variety of miscellaneous other private owners hold 26 percent of the total commercial forest area. Private owners also hold nearly a third of the noncommercial forest lands in the United States and Coastal Alaska.

Public holdings comprise 27 percent of all commercial forests. National forests represent the most important class of public holdings, with 17 percent of the total commercial forest area. Other Federal holdings include 4 percent of the total, and 6 percent is in State and local public ownerships.

In the eastern regions, where practically all lands at one time passed into private ownership, most of the commercial forest land is still in private holdings. In the South, 91 percent of the commercial forest area is privately owned and, in the North, 81 percent. In the West and Coastal Alaska, on the other hand, most of the commercial forest land is still federally owned or administered; only 33 percent of the western commercial forests are in private holdings.

[49] Statistical data presented here pertain chiefly to sections or to the Nation as a whole. Statistics by States and regions are given in the appendix, page 499.

Table 163.—*Ownership of commercial forest land in the United States and Coastal Alaska, by section, 1953*

Type of ownership	All sections		North	South	West	Coastal Alaska
	Area	Proportion				
	Thousand acres	*Percent*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Private:						
Forest industries:						
Lumber manufacturer	34, 687	7. 1	3, 955	18, 517	12, 215	
Pulp manufacturer	23, 276	4. 8	9, 224	12, 188	1, 864	
Other wood manufacturer	4, 419	. 9	924	2, 818	677	
Total	62, 382	12. 8	14, 103	33, 523	14, 756	
Farm	165, 217	33. 8	61, 394	90, 143	13, 680	
Other private	130, 670	26. 7	66, 118	52, 943	11, 590	19
Total, all private	358, 269	73. 3	141, 615	176, 609	40, 026	19
Public:						
National forest	84, 759	17. 4	10, 282	10, 372	60, 660	3, 445
Indian [1]	6, 965	1. 4	1, 488	117	5, 340	20
Bureau of Land Management [1]	6, 298	1. 3	72	154	5, 287	785
Other Federal	5, 102	1. 0	1, 252	3, 553	297	
Total, Federal	103, 124	21. 1	13, 094	14, 196	71, 584	4, 250
State	19, 169	3. 9	12, 546	1, 857	4, 766	
County	7, 048	1. 5	6, 786	626	635	
Municipal and local	999	. 2				
Total, all public	130, 340	26. 7	32, 426	16, 679	76, 985	4, 250
All ownerships	488, 609	100. 0	174, 041	193, 288	117, 011	4, 269

[1] Because of different definitions of commercial forest land, figures for these ownerships may vary from published figures of the public agencies concerned.

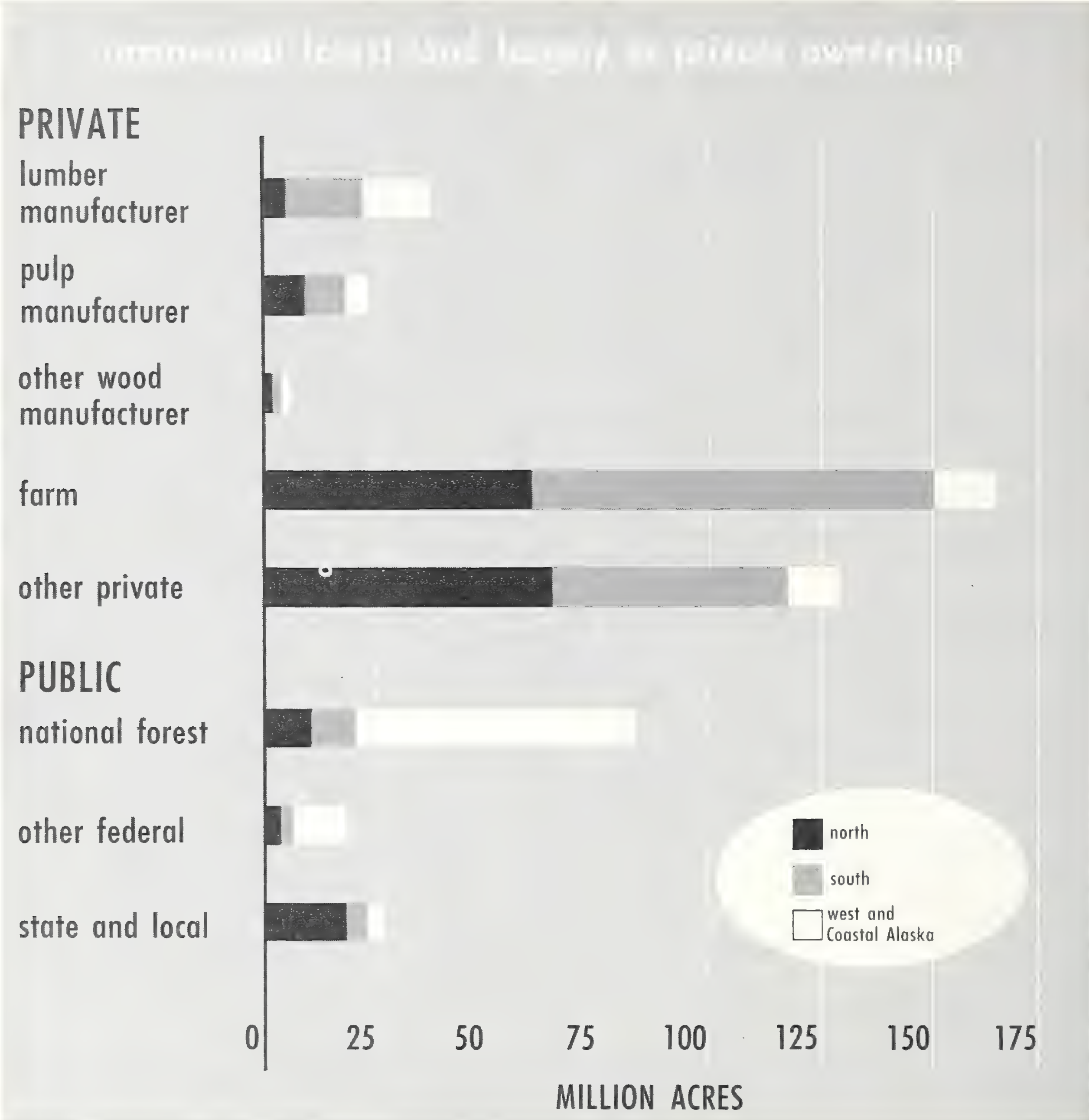


Figure 94

Private Lands Chiefly in Small Holdings

The private commercial forest lands in the Nation are widely dispersed in an estimated 4,510,500 separate ownerships (table 164). Although individual holdings of forest land vary widely in size from 3 acres to more than 2 million, the average private ownership is only 79 acres.

"Small" holdings of less than 5,000 acres are of particular importance. More than half of the total commercial forest land in the country—or 265 million acres—is in these small private holdings (table 164 and fig. 95). A quarter of the total commercial forest area is in private holdings of less than 100 acres.

"Medium"-size ownerships of 5,000 to 50,000 acres of forest land account for about 7 percent of

the total commercial forest area. There are about 2,330 of these holdings, with a total area of 35 million acres.

TABLE 164.—*Number of private ownerships of commercial forest land and area owned in the United States and Coastal Alaska, by size of holding and section, 1953* [1]

Size of ownership (acres)	Ownerships	Area	Proportion of commercial forest area	Average size of holding
	Number	*Thousand acres*	*Percent*	*Acres*
ALL SECTIONS				
Less than 100 [1]	3, 875, 093	121, 023	24. 8	31
100–500	586, 467	97, 882	20. 0	167
500–5,000	46, 326	46, 378	9. 5	1, 001
Total	4, 507, 886	265, 283	54. 3	59
5,000–50,000 [2]	2, 330	34, 669	7. 1	14, 879
Over 50,000 [2]	283	58, 317	11. 9	206, 067
Total	4, 510, 499	358, 269	73. 3	79
NORTH				
Less than 100 [1]	2, 316, 089	69, 338	14. 2	30
100–500	224, 935	37, 608	7. 7	167
500–5,000	12, 259	10, 214	2. 1	833
Total	2, 553, 283	117, 160	24. 0	46
5,000–50,000 [2]	563	8, 279	1. 7	14, 705
Over 50,000 [2]	75	16, 176	3. 3	215, 680
Total	2, 553, 921	141, 615	29. 0	55
SOUTH				
Less than 100 [1]	1, 476, 478	48, 315	9. 9	33
100–500	322, 414	52, 449	10. 7	163
500–5,000	26, 605	27, 428	5. 6	1, 031
Total	1, 825, 497	128, 192	26. 2	70
5,000–50,000 [2]	1, 367	20, 140	4. 1	14, 733
Over 50,000 [2]	156	28, 277	5. 8	181, 263
Total	1, 827, 020	176, 609	36. 1	97
WEST AND COASTAL ALASKA				
Less than 100 [1]	82, 526	3, 370	0. 7	41
100–500	39, 118	7, 825	1. 6	200
500–5,000	7, 462	8, 736	1. 8	1, 171
Total	[3] 129, 106	19, 931	4. 1	154
5,000–50,000 [2]	409	6, 400	1. 3	15, 648
Over 50,000 [2]	62	13, 714	2. 8	221, 194
Total	129, 577	40, 045	8. 2	310

[1] Number of ownerships shown for holdings of 3–100 acres in the East and 10–100 acres in the West.

[2] Ownerships in a given size class on a sectional basis do not add to national totals because holdings of a given owner located in different regions were combined in determining number of ownerships on a national basis.

[3] Includes 286 ownerships in Coastal Alaska.

"Large" private holdings of more than 50,000 acres of forest land number 283. They represent a total area of 58 million acres, or 12 percent of all commercial forests. Seven of these large ownerships average 2,103,000 acres, and together include roughly 3 percent of the Nation's commercial forest land, as shown in the following tabulation:

Size class (acres):	Ownerships (*number*)	Commercial forest area (*million acres*)	Average area per ownership (*acres*)
50,000–250,000	233	24. 3	104, 000
250,000–500,000	30	10. 7	358, 000
500,000–1,000,000	13	8. 6	658, 000
1,000,000 plus	7	14. 7	2, 103, 000
All classes	283	58. 3	206, 000

Since some owners hold land in more than one State, there are fewer medium and large ownerships on a regional or national basis than when size of ownership is determined by area owned within a State. Table 165 thus shows 325 large owners on a State basis, rather than 283 as shown above on a national basis.

SMALL HOLDINGS CONCENTRATED IN EAST

On a geographical basis, most of the private commercial forest lands in the northern and southern sections of the country are in small ownerships. In the West, on the other hand, only about half the total area in private ownership is in these holdings of less than 5,000 acres (table 164 and fig. 95).

In terms of numbers as well as area, private ownerships are concentrated in the East, with 57 percent of all private ownerships in the North and 40 percent in the South. Only 3 percent of the private ownerships are located in the West and Coastal Alaska. In the western regions, private ownerships include an average of 310 acres of forest land, compared with 97 acres in the South and only 55 acres in the North.

Comparisons of 1953 estimates with data from the 1945 Reappraisal show an increase of roughly 185,000 small owners (i. e., owners holding less than 5,000 acres), although exact figures cannot be determined because of changes in the basis of classification. There is some evidence of both subdivision of small holdings since 1945 and some consolidation of medium and large holdings.

FARM HOLDINGS LARGEST CLASS OF OWNERSHIP

There are some 3,382,500 farm forests—three-fourths of all private holdings of commercial forest land (table 166). Most of these farm forest ownerships are located in the North and South, with only about 64,000 in the West.

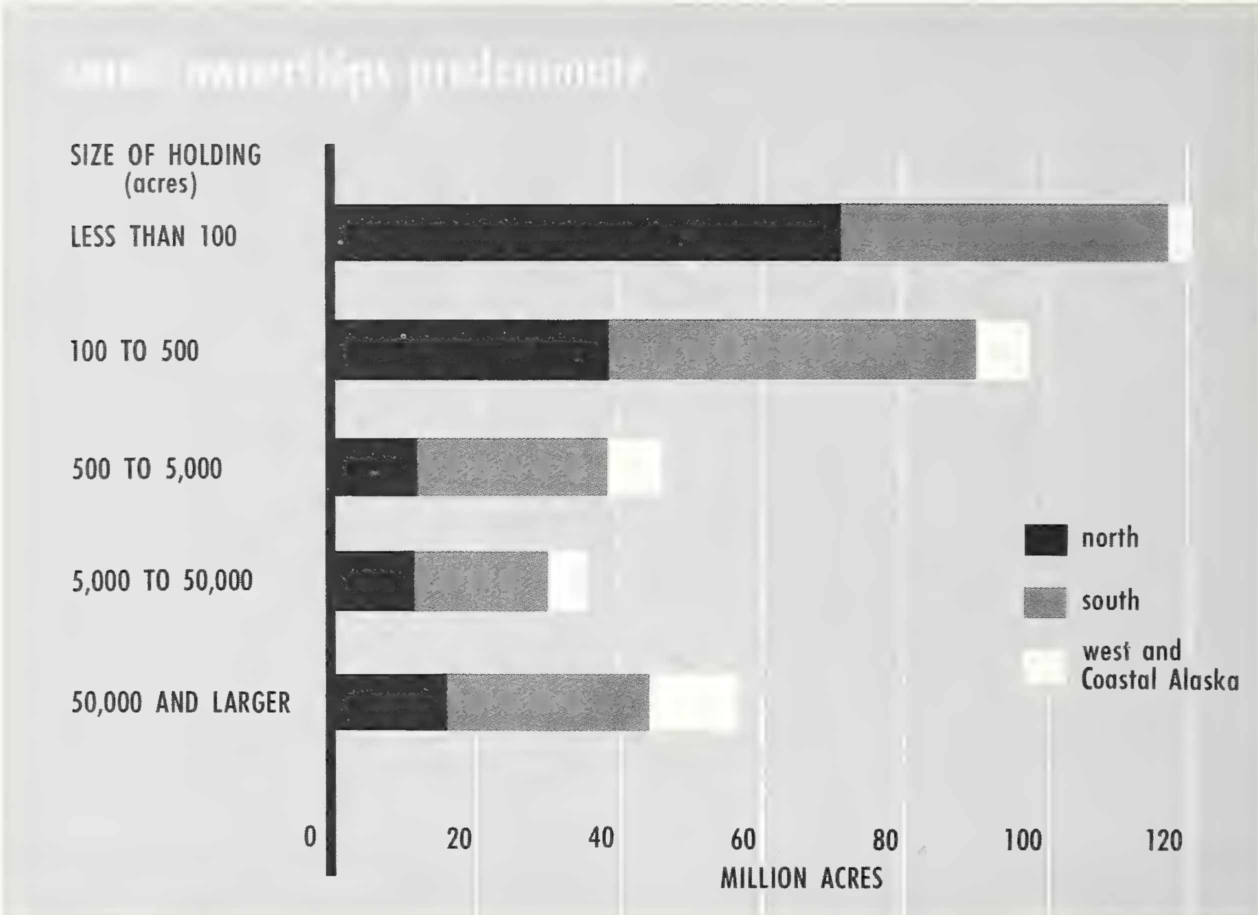


Figure 95

Forest industry holdings number about 23,450. Slightly more than half of these properties are in the South, about two-fifths in the North, and one-tenth in the West (table 166). In terms of number as well as acreage held, lumber manufacturers represent the principal type of owner in the forest industries.

Other private forest holdings, owned by a wide variety of individuals, groups, and corporations, number about 1,104,800, or nearly one-fourth of all private forest ownerships (table 166). As in the case of farm forests, these miscellaneous private ownerships are concentrated in the North and South.

Most Private Lands Support Young-Growth Stands

The privately owned lands in the United States and Coastal Alaska include a lower proportion of sawtimber stands, and more young-growth stands, than the public lands. Sawtimber stands comprise 33 percent of the 358.3 million acres of private forests, compared with 49 percent of the 130.3 million acres in public forests (table 167 and fig. 96). Many of the private sawtimber stands are young-growth, moreover, while public sawtimber stands include a large proportion of the remaining old-growth timber.

In the national forests is found the highest proportion of sawtimber stands—58 percent. The lowest proportion of 11 percent occurs on county and municipal lands. The differences in age and size of timber in private and public stands mainly reflect the heavier cutting that has taken place on the more accessible farm and other private forests, and the limited development of the relatively inaccessible national-forest and other Federal lands in the West.

TABLE 165.—*Number of private ownerships of commercial forest land on a State and regional, sectional, or national basis in the United States and Coastal Alaska, by size class, 1953* [1]

Section and region	State basis [1]			Regional, sectional, or national basis [2]	
	Small	Medium	Large	Medium	Large
	Number	*Number*	*Number*	*Number*	*Number*
North:					
New England	254, 378	160	33	141	31
Middle Atlantic	764, 124	239	24	239	24
Central	885, 984	83	4	83	4
Lake	491, 774	93	23	87	21
Plains	157, 023	20		20	
Total	2, 553, 283	595	84	563	75
South:					
South Atlantic	594, 165	268	25	244	23
Southeast	777, 620	893	83	827	82
West Gulf	453, 712	331	64	308	57
Total	1, 825, 497	1, 492	172	1, 367	156
West:					
Pacific Northwest	83, 696	191	33	186	30
California	10, 307	141	16	141	16
Northern Rocky Mountains	27, 130	39	9	37	9
Southern Rocky Mountains	7, 687	58	11	56	11
Total	128, 820	429	69	409	62
Coastal Alaska	286				
All regions	4, 507, 886	2, 516	325	2, 330	283

[1] Size of an individual holding determined by area held within a given State. Small=3–5,000 acres in East and 10–5,000 acres in the West. Medium=5,000–50,000 acres. Large=more than 50,000 acres.

[2] Size of an individual holding determined by area held within a region, section, or the country as a whole. Number of owners less on region than on State basis, and still less on section or national basis because of duplication of owners.

TABLE 166.—*Number of private ownerships on commercial forest land in the United States and Coastal Alaska, by type of ownership and section, 1953* [1]

Type of ownership	All sections	North	South	West	Coastal Alaska
	Number	*Number*	*Number*	*Number*	*Number*
Forest industries:					
Lumber manufacturer	21, 284	8, 053	11, 170	2, 061	
Pulp manufacturer	159	69	62	28	
Other wood manufacturer	2, 009	705	973	331	
Total	23, 452	8, 827	12, 205	2, 420	
Farm	3, 382, 502	1, 928, 752	1, 389, 804	63, 946	
Other private	1, 104, 773	616, 383	425, 152	62, 952	286
Total, all private	4, 510, 727	2, 553, 962	1, 827, 161	129, 318	286

[1] Estimates available only on State basis; hence, figures given here exceed totals shown on a sectional and national basis in table 164.

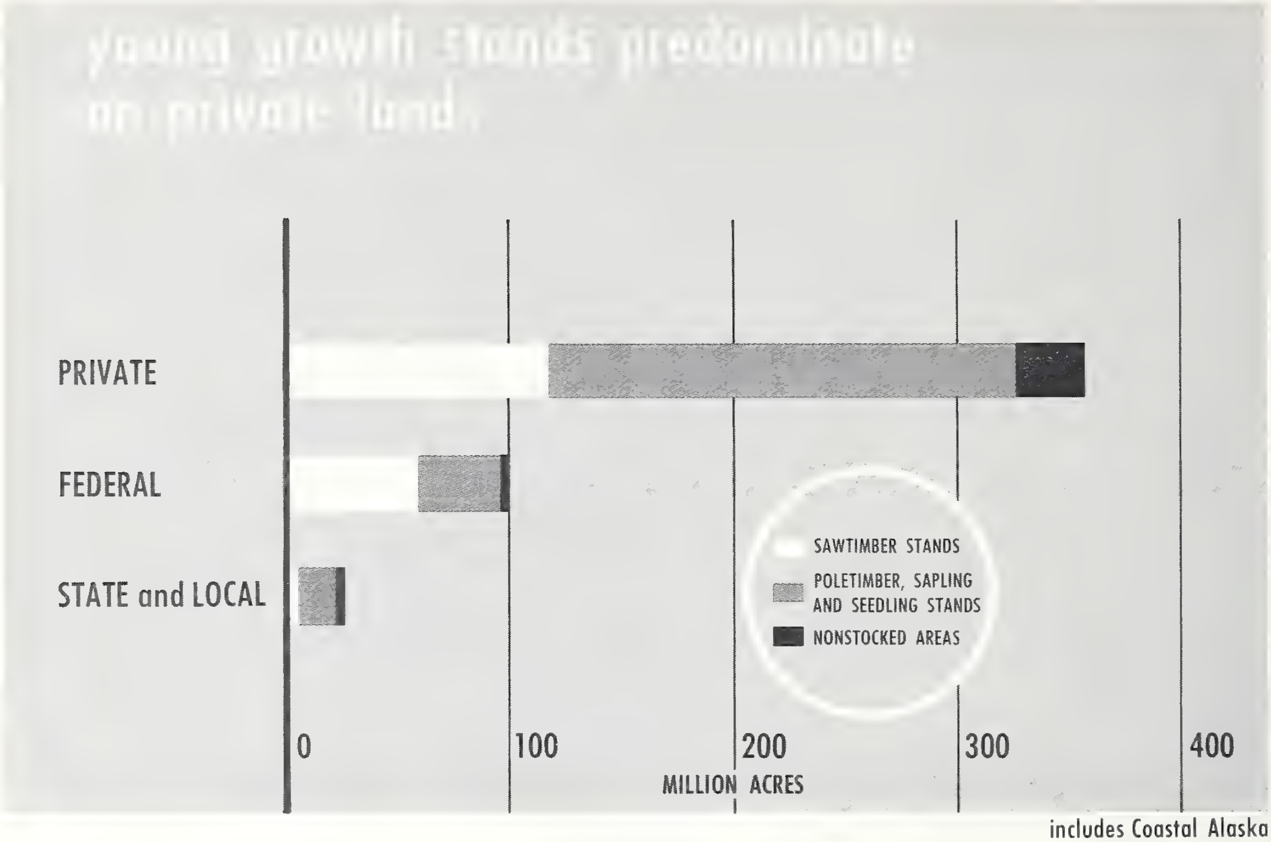


Figure 96

TABLE 167.—*Proportion of commercial forest land area in the various stand-size classes, by section and type of ownership, United States and Coastal Alaska, 1953*

Stand-size class	All sections						
	All owners	Private	Total public	National forest	Other Federal	State	County and municipal
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Sawtimber stands	37	33	49	58	56	22	11
Poletimber stands	35	38	25	24	21	34	29
Seedling and sapling stands	19	20	17	12	12	29	42
Nonstocked and other areas	9	9	9	6	11	15	18
All classes	100	100	100	100	100	100	100

Stand-size class	North		South		West		Coastal Alaska	
	Private	Public	Private	Public	Private	Public	Private	Public
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Sawtimber stands	30	16	31	35	52	64	84	95
Poletimber stands	39	34	41	38	25	20	11	2
Seedling and sapling stands	23	36	20	17	12	10	5	2
Nonstocked and other areas	8	14	8	10	11	6	----------	1
All classes	100	100	100	100	100	100	100	100

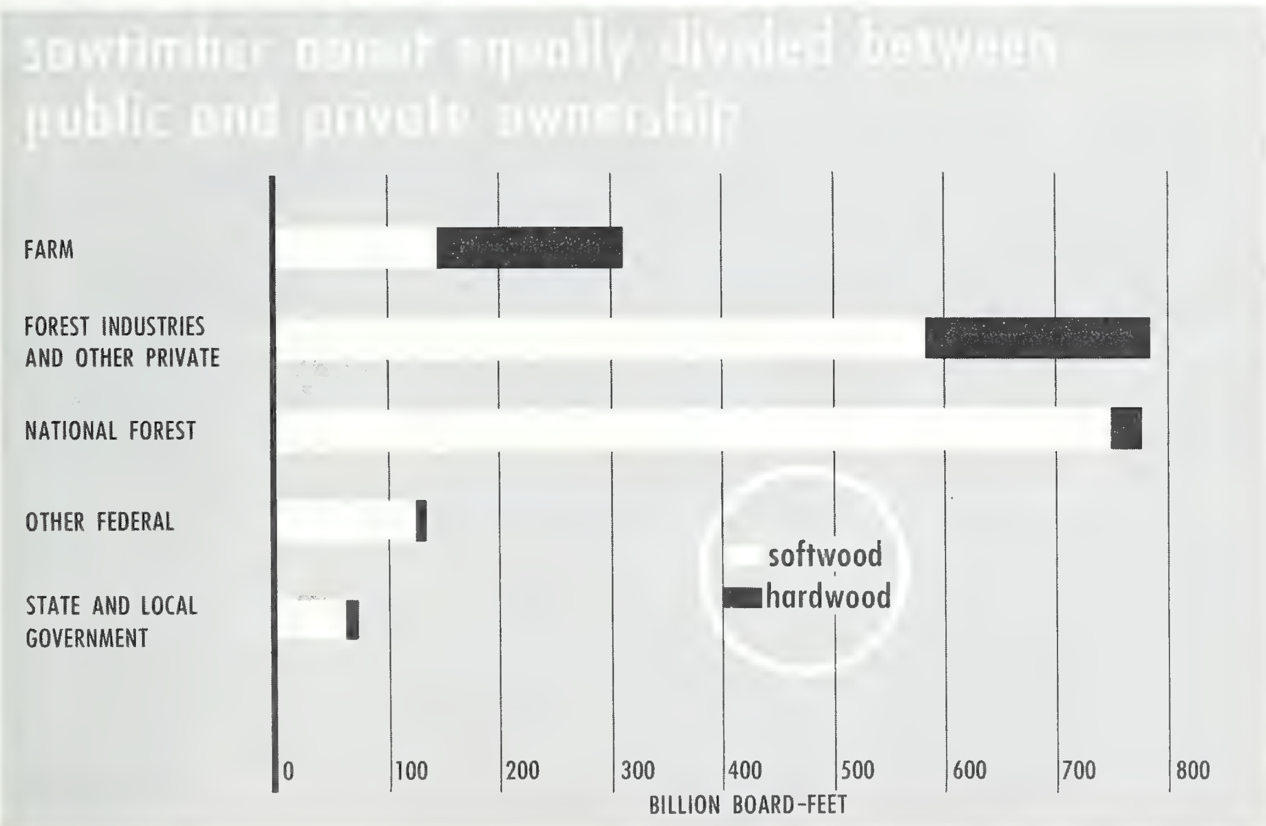
On a sectional basis, there is considerable variation in types of stands held by both private and public owners. Thus, in the North and South about 30 percent of the private holdings support sawtimber stands (table 167). Public ownerships in the East average somewhat less sawtimber area than the private lands, and include relatively large nonstocked areas. In the West, sawtimber stands cover 64 percent of the public and 52 percent of the private commercial forest land.

Sawtimber About Equally Distributed Between Private and Public Ownerships

Largely as a result of the heavier cutting that has taken place on private holdings, the 73 percent of the commercial forest land in private ownerships supports only 53 percent of the sawtimber volume and about 59 percent of the total growing stock (tables 168 and 169). Farm forests are in relatively poor condition from the standpoint of sawtimber volume; though comprising one-third of the total commercial forest land, they support only 15 percent of the present sawtimber volume (fig. 97). Forest industry and other private holdings, constituting 40 percent of the total commercial forest land, support about 38 percent of the total sawtimber volume.

The national forests contain a high proportion of the present volume of sawtimber. Although these public lands account for only 17 percent of the commercial forest area, they contain 37 percent of the total sawtimber volume. Other Federal, State, and local public holdings include about 10 percent of the sawtimber.

Private holdings include most of the sawtimber in the North and the South—about 90 percent of the total (table 168). In the West, on the other hand, about 60 percent of the sawtimber is on public lands, with 48 percent of the western sawtimber in the national forests alone. Most of the sawtimber in Coastal Alaska also is on national-forest lands.



includes Coastal Alaska

Figure 97

TABLE 168.—*Ownership of sawtimber in the United States and Coastal Alaska, by section, 1953*

Type of ownership	All sections		North	South	West	Coastal Alaska
	Volume	Proportion				
	Billion bd.-ft.	*Percent*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*
Private:						
Farm	308	15.0	102	144	62	
Forest industries and other private	772	37.5	132	178	462	(1)
Total	1,080	52.5	234	322	524	(1)
Public:						
National forest	766	37.2	13	23	647	83
Indian [2]	45	2.2	2	(1)	43	(1)
Bureau Land Management [2]	80	3.9	(1)	1	73	6
Other Federal	10	.5	2	7	1	
State	64	3.1	11	3	50	
County and municipal	12	.6	4	1	7	
Total	977	47.5	32	35	821	89
All ownerships	2,057	100.0	266	357	1,345	89

[1] Less than 0.5 billion board-feet.
[2] Because of different definitions of commercial forest land, and different cruising standards, specifications, and log rules, estimates for these ownerships may vary from published figures of the public agencies concerned.

TABLE 169.—*Ownership of sawtimber and growing stock in the United States and Coastal Alaska, by softwoods and hardwoods, 1953*

Type of ownership	Sawtimber			Growing stock		
	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
	Billion bd.-ft.	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*
Private:						
Farm	308	140	168	103	(1)	(1)
Forest industries and other private	772	579	193	201	(1)	(1)
Total	1,080	719	361	304	(1)	(1)
Public:						
National forest	766	740	26	163	152	11
Other Federal	135	127	8	28	25	3
State	64	53	11	18	(1)	(1)
County and municipal	12	9	3	4	(1)	(1)
Total	977	929	48	213	(1)	(1)
All ownerships	2,057	1,648	409	517	355	162

[1] Not available.

Over Half the Softwood Sawtimber on Public Lands

Distribution of ownership of softwood sawtimber is especially significant, because softwood species make up close to four-fifths of all timber products cut in the United States and nearly as large a proportion of prospective requirements. At the present time, private forests support 44 percent of the softwood sawtimber (table 169). About 45 percent of the total softwood sawtimber volume is on the national forests, and 11 percent is on other public holdings.

This distribution of volume implies large dependence on public timber in the immediate future. In the long run, however, when the cut is obtained solely from second-growth stands, it is to be expected that private forests will contribute more in proportion to their area and thus supply as much as three-fourths or more of the prospective future growth.

Present hardwood sawtimber resources, unlike the softwood, are mainly found on private lands. About 41 percent of the hardwood sawtimber volume is on farms, 47 percent is on other private lands, and 12 percent is in public holdings.

Problems Relate to Both Type and Size of Ownership

Both type of ownership and size of holdings, as well as possible relationships between these factors, must be considered in appraising forest conditions and programs. Forest industry ownerships, for example, differ in many important respects from the large groups of farm and "other" private ownerships. Consequently, each class of ownership will be discussed separately.

FOREST INDUSTRY OWNERSHIPS

Holdings of Lumber Manufacturers Predominate

Lumber companies, pulp companies, and other primary manufacturers of wood products together hold 62 million acres, or about 13 percent of the commercial forest area (table 170). Lumber manufacturers represent the largest class of forest industry owners with 35 million acres, or 56 percent of all forest industry lands. Pulp companies own 23 million acres, or about 37 percent of these industrial holdings, and other wood manufacturers own 4 million acres, or 7 percent of the total. As indicated in table 166, there are an estimated 23,452 forest industry ownerships in the United States, including 21,284 lumber manufacturers, 159 pulp companies, and 2,009 manufacturers of other wood products.

Industrial Lands Chiefly in Large and Medium-Sized Holdings

About two-thirds of the commercial forest land held by forest industries is in "large" ownerships of more than 50,000 acres (table 170 and fig. 98). "Medium" holdings include one-fourth of the industrial forest area. "Small" holdings of less than 5,000 acres account for about one-tenth of these industry lands.

Most of the pulp company holdings are in large ownerships. About half the lands of lumber manufacturers and a third of the area held by other wood manufacturers are also in large holdings. A general concentration in large and medium-sized holdings is evident in all sections (fig. 98) and in all regions except the Central States (table 171).

Industrial Holdings Concentrated in the South

Somewhat more than half of the 62 million acres owned by forest industries is located in the South (table 172 and fig. 98). The balance of the area is divided about equally between the North and the West. Concentration of industrial holdings in the South is characteristic of all the forest industries, each having somewhat more than half its lands in this section. Extensive holdings of lumber manufacturers, including companies producing wood pulp and other products as well as lumber, are also found in the West, with relatively small holdings in the North. Holdings of pulp companies and other wood manufacturers, on the other hand, are more extensive in the North than in the West.

Little information is available to indicate timber volumes present on the lands of forest industries. Forest industry lands account for 13 percent of all commercial forest land, but it is believed they support a larger fraction of the timber volume. Considerable areas of old-growth timber in the Western States are held in industrial ownerships. In many cases, forest industries in recent years also have attempted to minimize cutting on company lands in order to build up the quantity and quality of timber on their holdings.

Figure 98.—Ownership of private commercial forest land in the United States, and size of holdings, 1953.

TABLE 170.—*Area owned and proportion of commercial forest land, by private owner class and size of holdings, in the United States and Coastal Alaska, 1953*

AREA OWNED

Type of ownership	Total	Less than 100 acres	100–500 acres	500–5,000 acres	5,000–50,000 acres	Over 50,000 acres
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Forest industries:						
Lumber manufacturer	34, 687	467	1, 905	3, 137	10, 634	18, 544
Pulp manufacturer	23, 276			147	1, 278	21, 851
Other wood manufacturer	4, 419	23	225	137	2, 451	1, 583
Total	62, 382	490	2, 130	3, 421	14, 363	41, 978
Farm	165, 217	77, 781	59, 219	23, 132	4, 534	551
Other private	130, 670	42, 752	36, 533	19, 825	15, 772	15, 788
Total, all private	358, 269	121, 023	97, 882	46, 378	34, 669	58, 317

PROPORTION OF COMMERCIAL FOREST

Type of ownership	Total	Less than 100 acres	100–500 acres	500–5,000 acres	5,000–50,000 acres	Over 50,000 acres
Forest industries:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Lumber manufacturer	7. 1	0. 1	0. 4	0. 6	2. 2	3. 8
Pulp manufacturer	4. 8			(1)	. 3	4. 5
Other wood manufacturer	. 9	(1)	(1)	(1)	. 5	. 4
Total	12. 8	. 1	. 4	. 6	3. 0	8. 7
Farm	33. 8	15. 9	12. 1	4. 8	. 9	. 1
Other private	26. 7	8. 8	7. 5	4. 1	3. 2	3. 1
Total, all private	73. 3	24. 8	20. 0	9. 5	7. 1	11. 9

[1] Less than 0.1 percent.

Area of Industrial Holdings Shows Moderate Increase

In recent years, many pulp companies and certain other forest industries have adopted aggressive land-acquisition programs. Between 1945 and 1953, for example, pulp company holdings increased by 8.5 million acres. In the same period, however, lumber company holdings declined by nearly 2 million acres, largely through transfer to pulp companies. The net acquisition of 6.6 million acres by pulp and lumber manufacturers combined in the 8-year period 1945–53 thus amounted to an increase of 13 percent.

The comparatively small acreage of land held by forest industries partly reflects the historical practice of obtaining stumpage, logs, pulpwood, or other products from other private land and from public land through contract or open-market purchase. Most small sawmill operators, for example, own no timberland and depend on purchased stumpage. The major part of the United States' pulpwood cut also is obtained from non-industry lands.

Until about 1930, lumber manufacturers generally disposed of timberlands after logging by selling them for agricultural or other purposes; by allowing them to revert to local governments through tax delinquency; by selling them to the Federal Government; or by exchanging them for public timber, a practice which the Government has now largely discontinued. Only recently have profit possibilities in the growing of timber crops and the need to hold timberlands for protection of permanent plant investments become generally recognized throughout the forest industries.

Productivity of Forest Industry Holdings Relatively High

Productivity of recently cut lands is relatively good on forest industry holdings in comparison with other types of ownership (table 173).[50] On pulp company lands, 84 percent of the recently cut area qualified for the upper productivity class, 15 percent for the medium class, and only 1 percent

[50] For a detailed discussion of concepts and findings relating to productivity, see Productivity of Recently Cut Lands, page 223.

TABLE 171.—*Area of commercial forest land owned by forest industries in the United States and Coastal Alaska, by region and size class of ownership, 1953* [1]

Section and region	Total commercial forest land	Forest industry ownerships					
		Total	Under 100 acres	100–500 acres	500–5,000 acres	5,000–50,000 acres	Over 50,000 acres
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
North:							
New England	30, 658	8, 178	61	198	371	1, 023	6, 525
Middle Atlantic	42, 225	2, 069	59	228	284	493	1, 005
Lake States	53, 272	3, 039	36	62	102	639	2, 200
Central	42, 394	817	56	66	347	97	251
Plains	5, 492						
Total	174, 041	14, 103	212	554	1, 104	2, 224	9, 989
South:							
South Atlantic	46, 152	5, 614	109	583	226	1, 518	3, 178
Southeast	94, 985	15, 443	96	299	626	4, 600	9, 822
West Gulf	52, 151	12, 466	49	383	356	2, 353	9, 325
Total	193, 288	33, 523	254	1, 265	1, 208	8, 436	22, 360
West:							
Pacific Northwest	45, 365	8, 880	24	231	503	2, 083	6, 039
California	17, 317	3, 389		55	231	1, 486	1, 617
Northern Rocky Mountain	33, 840	2, 331		21	351	251	1, 708
Southern Rocky Mountain	20, 489	156		4	24	6	122
Total	117, 011	14, 756	24	311	1, 109	3, 792	9, 520
Coastal Alaska	[2] 4, 269						
All regions	488, 609	62, 382	490	2, 130	3, 421	14, 363	41, 978

[1] Area in a given size class on a regional basis does not add to sectional or national totals because holdings of a given owner located in different regions have been combined in determining size class of ownerships on a sectional basis.

[2] Area owned by forest industries in Coastal Alaska was not reported.

for the lower class, as shown by the following tabulation:

	Proportion of recently cut land in productivity class		
	Upper (percent)	*Medium (percent)*	*Lower (percent)*
Lumber manufacturer:			
North	68	24	8
South	69	23	8
West	78	19	3
All regions	73	21	6
Pulp manufacturer:			
North	66	33	1
South	96	4	([1])
West	94	1	5
All regions	84	15	1
Other wood manufacturer:			
North	53	38	9
South	78	22	([1])
West	73	9	18
All regions	73	23	4

[1] Less than 0.5 percent.

On holdings of lumber and other wood manufacturers, the record was nearly as favorable. On these holdings, about 73 percent of the recently cut area was qualified for the upper productivity class and only about 5 percent for the lower class. Relatively little difference was evident from section to section within each industry, except for lands owned by pulp and other wood manufacturers in the North. There, the proportion of recently cut areas in the various productivity classes was lower than for similar industrial lands in other sections.

Productivity of recently cut lands on forest industry properties averaged higher on the medium and large holdings than on the limited areas of small industrial ownerships (table 174).

In most instances, productivity of recently cut land for industry holdings was also substantially better than for farm and other private holdings that currently supply the major part of the raw material for forest industry. This is believed to reflect a widespread interest in permanent timber growing by the forest industries and the fact that

TABLE 172.—*Area of commercial forest land owned by forest industries in the continental United States, by region and type of industry, 1953*

Section and region	Total forest industries	Lumber manufacturer	Pulp manufacturer	Other wood manufacturer
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*
North:				
New England	8, 178	1, 002	6, 840	336
Middle Atlantic	2, 069	977	889	203
Lake States	3, 039	1, 435	1, 495	109
Central	817	541	-------	276
Total	14, 103	3, 955	9, 224	924
South:				
South Atlantic	5, 614	2, 620	2, 603	391
Southeast	15, 443	6, 587	6, 963	1, 893
West Gulf	12, 466	9, 310	2, 622	534
Total	33, 523	18, 517	12, 188	2, 818
West:				
Pacific Northwest	8, 880	6, 858	1, 681	341
California	3, 389	3, 076	173	140
Northern Rocky Mountain	2, 331	2, 131	10	190
Southern Rocky Mountain	156	150	-------	6
Total	14, 756	12, 215	1, 864	677
All regions [1]	62, 382	34, 687	23, 276	4, 419

[1] Area owned by forest industries in Coastal Alaska was not reported.

small sawmill operators, pulpwood contractors, and other loggers generally cut purchased timber on farm and other private forests with less care than on company lands. Farmers and other private owners usually sell their timber without cutting restrictions, and in such cases logging operators frequently leave the land in relatively poor condition for continued timber production.

Management Programs Adopted by Forest Industry

In an effort to improve both the quantity and quality of timber growth, many pulp companies and certain other forest industry owners have been investing in stand-improvement measures such as cull tree removal and release cutting in both natural and planted stands. Thus, in the period 1947–53, 45 percent of the pulp manufacturing companies, with 58 percent of all pulp company lands, were applying some form of stand improvement on a part of their ownerships. This was considerably in excess of the efforts by lumber companies and far more than the average of 2 percent of all private owners. Stand-improvement efforts were especially important on pulp company lands in the South.

Forest industries are also making a large contribution to fire protection on their lands by supplementing the efforts of public fire control agencies. In 1952, private expenditures for fire control, derived to a large extent from industrial forest owners, amounted to $10,500,000, or 17 percent of all expenditures for organized fire control.

To an increasing degree, the larger private timber owners are cooperating in the detection and control of insects and disease, and in many areas forest industry is salvaging timber killed by insects or other destructive agents.

Tree planting programs of forest industries have also been steadily expanding. In 1953, the forest industries in the United States planted 220,000 acres, or 31 percent of the total area of new plantations. Industry plantings of about 1 million acres represented 12 percent of the total area planted up to and including 1953. About 90 percent of the industry plantings in 1953, and 75 percent of all existing plantations, were located in the South.

TABLE 173.—*Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by type of ownership* [1]

Type of ownership	Proportion of area by productivity class		
	Upper	Medium	Lower
Private:			
Forest industries:	*Percent*	*Percent*	*Percent*
Lumber manufacturer	73	21	6
Pulp manufacturer	84	15	1
Other wood manufacturer	73	23	4
Average	77	19	4
Farm	41	37	22
Other private	52	28	20
Average	56	29	15
Public:			
National forest	81	16	3
Bureau of Land Management	80	15	5
Indian	74	25	1
Other Federal	80	16	4
State	77	18	5
County	76	24	-------
Municipal and local	93	6	1
Average	80	17	3
All ownerships	65	24	11

[1] Recently cut lands (or operating area) in an ownership is the area of forest types in which there was some commercial cutting in the period 1947–54.

TABLE 174.—*Productivity of recently cut private commercial forest land in the continental United States, by type and size class of ownership* [1]

Size and productivity classes	Private ownerships	Forest industry: Total	Forest industry: Lumber manufacturers	Forest industry: Pulp manufacturers	Forest industry: Other wood manufacturers	Farm	Other private
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Less than 5,000 acres:							
Upper	40	48	48	22	62	40	41
Medium	36	36	35	75	38	38	31
Lower	24	16	17	3	----------	22	28
5,000–50,000 acres:							
Upper	64	74	74	79	73	55	56
Medium	26	20	20	12	24	29	31
Lower	10	6	6	9	3	16	13
More than 50,000 acres:							
Upper	78	81	78	84	74	84	69
Medium	18	17	19	15	18	16	21
Lower	4	2	3	1	8	----------	10
All size classes:							
Upper	56	77	73	84	73	41	52
Medium	29	19	21	15	23	37	28
Lower	15	4	6	1	4	22	20

[1] Recently cut lands (or operating area) in an ownership is the area of forest types in which there was some commercial cutting in the period 1947–54.

For the country as a whole, however, acceptable plantations in 1952 totaled only 5.2 million acres, while the plantable area amounted to about 52 million acres. The future need for planting applies in all sections and all ownerships.

Several Factors Favor Industrial Forestry

The rapid expansion of forestry programs by the timber industries reflects an increasing recognition of the present and prospective profitability of timber growing in favorable areas. In addition, in many cases companies with large investments in pulp mills or other wood-using plants have been acquiring land and adopting intensive programs of tree planting and other forestry measures in order to provide dependable future supplies of raw materials.

The increasing effectiveness of public fire control programs has tended to stimulate tree planting and other forestry efforts on private lands. Adequate capital in general has been readily available to the forest industries for land acquisition and improvement. Stability of land tenure through corporate organization, and integration of timber growing with utilization in pulp mills and other manufacturing plants, also represent significant reasons for the widespread growth of industrial forestry.

Financial factors are also playing a part in the development of industrial forestry. Capital gains provisions, adopted in 1943, of the Internal Revenue Code have made timber growing more attractive and have provided an important incentive for more aggressive forestry programs. The tax amortization program, initiated at the outbreak of the Korean War, permitted write-off over a 5-year period of such part of the investment in new industrial facilities as was certified as essential to the national defense during the emergency. As a result, rapid expansion of plant capacity was encouraged.

Local property taxes on forest land and timber have in general been less onerous in recent years, partly because such levies have tended to lag behind the upward movement of timber values and the general price level during inflationary periods. Yield taxes and other special forest tax laws favoring forest enterprise are in effect in many of the States.

Credit secured by forest land and timber is becoming increasingly available. A number of life insurance companies in the forest credit field make loans for terms up to 30 years. National banks, under legislation adopted in 1953, are authorized to make loans secured by forest tracts for terms up to 10 years.

Insurance of standing timber against loss by fire has long been advocated as a stimulus to forest credit and investment. During the past 2 years, such insurance has for the first time been aggressively promoted by a group of commercial insurance underwriters.

Outstanding progress has been made by industries in the South and Pacific Northwest,

where timber growing, production, and market factors have been relatively favorable, but all sections have shared in the advance of industrial forestry.

Industry faces certain problems in further expansion, such as increasing difficulty in acquiring timber tracts of substantial size and a large increase in forest land prices. In some areas, moreover, there is considerable local opposition toward large company acquisition. The pulp industry in some cases has attempted to meet this problem by maintaining a market for wood produced by farmers and other small owners, by selling sawtimber produced on company lands to small local sawmills or other local wood users, and by providing technical forestry assistance to small landowners and timber operators.

Although industry holdings comprise only 13 percent of the commercial forests, they include some of the most accessible, productive, and well-managed forests—a significant part of the Nation's timber resources. These industrial ownerships, therefore, must be counted on to supply a sizable share of the Nation's future wood requirements.

Forest industry may be of even larger significance through demonstration, education, and assistance to other private forest landowners who supply most of the raw material for wood-using plants. The forest industries also are in a position to influence the cutting practices of the independent logging operators who cut timber on farm and other private forest ownerships for delivery to wood-manufacturing plants.

FARM AND OTHER PRIVATE OWNERSHIPS

The characteristics of the owners of farm and miscellaneous "other" private holdings, the forest problems they face, and the opportunities open to them in general differ from those of public and forest industry owners. Farm and other private ownerships include crop farmers and livestock ranchers, business and professional people, housewives, wage earners, mining and land holding companies, and a wide variety of other owners. Some of these owners manage their lands for the production of stumpage. Some farmers operate small sawmills but derive most of their income from nontimber sources and hence are included in the "farm" category. Although most farm and other private owners are interested primarily in occupations other than timber growing and manufacture, they represent the principal class of forest ownership in terms of area and potential yield.

Farm and Other Private Ownerships Include Three-fifths of Commercial Forest Land

The commercial forest land in farms and private ownerships other than forest industries amounts to 296 million acres, or 61 percent of the total commercial forest area in the United States and Coastal Alaska (table 163).

Farm holdings, which include lands owned both by farm operators and by other private owners who lease lands to farm operators, represent the largest class of forest ownership. Farm forests total 165 million acres, or 34 percent of the total commercial forest land.[51] "Other" private ownerships include 131 million acres, or nearly as much as the farm holdings.

Nearly half of the farm and other private holdings, 143 million acres, is in the South (table 175). There is also a large concentration of 128 million acres of such private holdings in the North. The western regions include only 25 million acres of farm and other private holdings. The acreage of private ownerships in Coastal Alaska is negligible.

Farm holdings are particularly numerous in the Central and South Atlantic Regions, where they account for more than half of the commercial forest land (fig. 99). In the Northeastern States, "other" private owners hold more than half of the commercial forest area (fig. 100).

Farm and Other Private Holdings Mostly Small

There are approximately 3.4 million farm forest ownerships in the United States and 1.1 million other private ownerships, or a total of 4,487,000 separate holdings (table 175). About 57 percent of these holdings are in the North, 40 percent in the South, and 3 percent in the West. In both North and South, the number of farm ownerships considerably exceeds that of other private owners, whereas they are about equal in the West.

"Small" forest holdings of less than 5,000 acres in farm and "other" private ownerships aggregate about 259 million acres, or 88 percent of all commercial forest lands in these ownership classes (table 176). "Medium" holdings of 5,000 to 50,000 acres of forest land aggregate 20 million acres. "Large" ownerships of more than 50,000 acres contain 16 million acres of forest land.

The farm ownerships on a nationwide basis average only 49 acres in size. The average farm

[51] An increase in estimated area of farm ownership from 139 million acres in the 1945 Reappraisal to 165 million acres, and a decrease of "other" private holdings from 155 to 131 million acres, is believed to be attributable largely to changes in definitions of farms and farm woodlands.

TABLE 175.—*Number and area of farm and "other" private ownerships of commercial forest land in the United States and Coastal Alaska, by section and region, 1953*

Section and region	Total farm and "other" private		Farm		"Other" private	
	Owner-ships	Area	Owner-ships	Area	Owner-ships	Area
	Thousands	*Million acres*	*Thousands*	*Million acres*	*Thousands*	*Million acres*
North:						
New England	252	21	94	6	158	15
Middle Atlantic	762	35	544	12	218	23
Lake States	491	29	371	15	120	14
Central	883	38	767	24	116	14
Plains	157	5	153	4	4	1
Total	2, 545	128	1, 929	61	616	67
South:						
South Atlantic	591	36	475	30	116	6
Southeast	774	72	617	46	157	26
West Gulf	450	35	298	14	152	21
Total	1, 815	143	1, 390	90	425	53
West:						
Pacific Northwest:						
Douglas-fir subregion	66	6	39	3	27	3
Pine subregion	16	4	6	2	10	2
Total	82	10	45	5	37	5
California	10	5	3	2	7	3
Northern Rocky Mountain	27	6	11	4	16	2
Southern Rocky Mountain	8	4	5	3	3	1
Total	127	25	64	14	63	11
Coastal Alaska	(1)	(1)	----	----	(1)	(1)
Total, all regions	4, 487	296	3, 383	165	1, 104	131

[1] Includes 286 "other" private owners with 19,000 acres of commercial forest land.

TABLE 176.—*Number of farm and "other" private ownerships of commercial forest land and area owned in the United States and Coastal Alaska, by size of holding, 1953*

Size of holding (acres)	Total farm and "other" private		Farm		Other private	
	Owner-ships	Area	Owner-ships	Area	Owner-ships	Area
	Thousands	*Thousand acres*	*Thousands*	*Thousand acres*	*Thousands*	*Thousand acres*
Less than 10 [1]	796	5, 058	671	4, 163	125	895
10 to 20	864	12, 168	742	10, 239	122	1, 929
20 to 30	580	13, 699	485	11, 205	95	2, 494
30 to 40	368	12, 390	279	9, 386	89	3, 004
40 to 50	354	15, 288	197	8, 453	157	6, 835
50 to 75	513	30, 071	324	18, 734	189	11, 337
75 to 100	389	31, 849	193	15, 601	196	16, 248
Total [2]	3, 864	120, 523	2, 891	77, 781	973	42, 742
100 to 500	623	95, 752	492	59, 219	131	36, 533
500 to 5,000		42, 957		23, 132		19, 825
5,000 to 50,000		20, 306		4, 534		15, 772
50,000 and larger		16, 339		551		15, 788
All holdings [2]	4, 487	295, 877	3, 383	165, 217	1, 104	130, 660

[1] East only. [2] Excludes 10,000 acres in Coastal Alaska for which breakdown was not available.

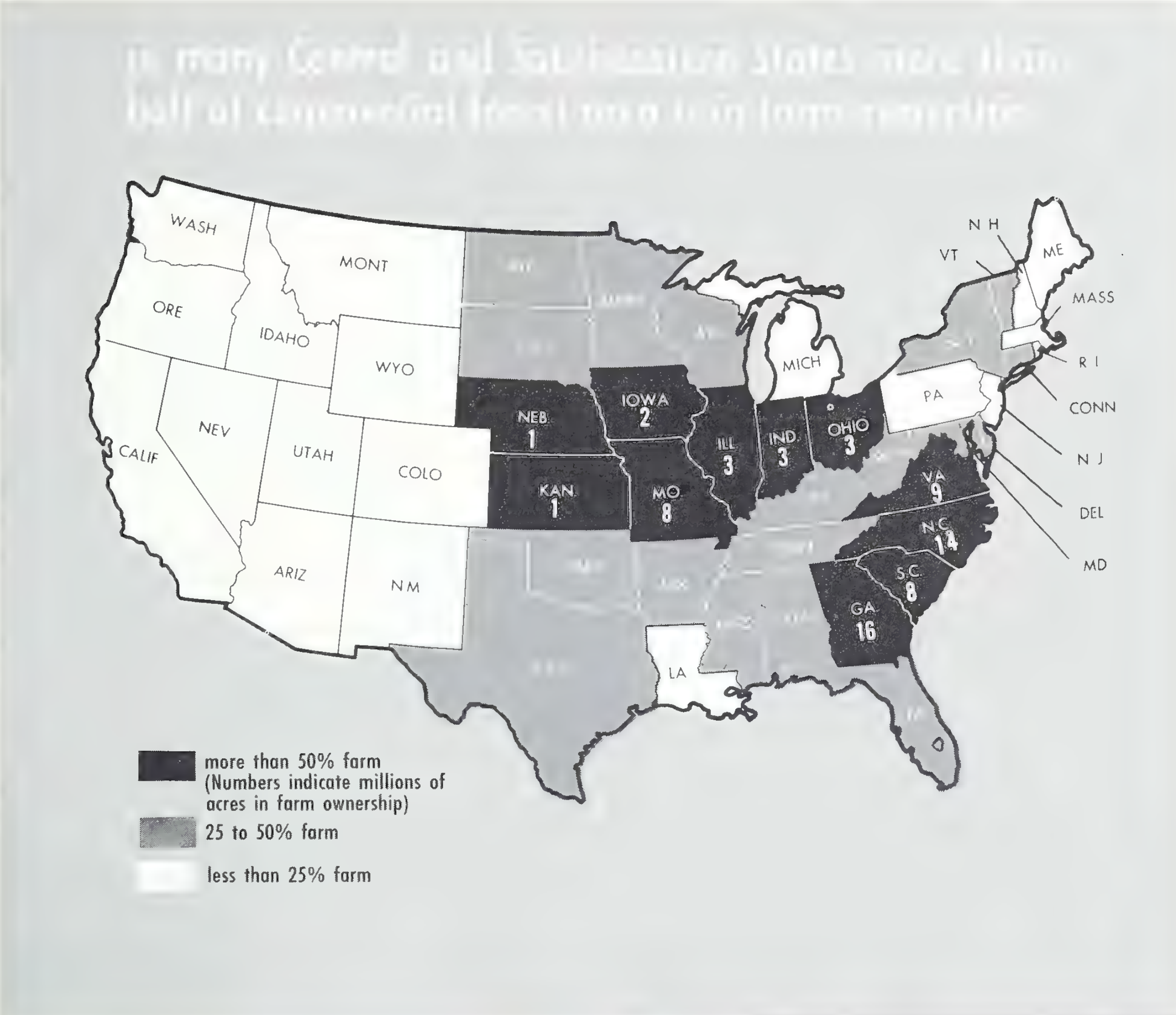


Figure 99

holding of 32 acres in the North is considerably smaller than the nationwide average. In the South, farm forests average 65 acres, and in the West 214 acres (table 175). "Other" private holdings average 118 acres in the country as a whole—over twice the average area of farm forests. In the North, "other" private holdings average 109 acres, in the South 124 acres, and in the West 184 acres.

Holdings of Less Than 100 Acres Predominate

The very small holdings of less than 100 acres account for 3.8 million out of 4.5 million holdings, or 86 percent of the total number of farm and "other" private ownerships (table 176). They include about 121 million acres, or 41 percent of the total area in this large ownership class. Nationwide, these holdings of less than 100 acres

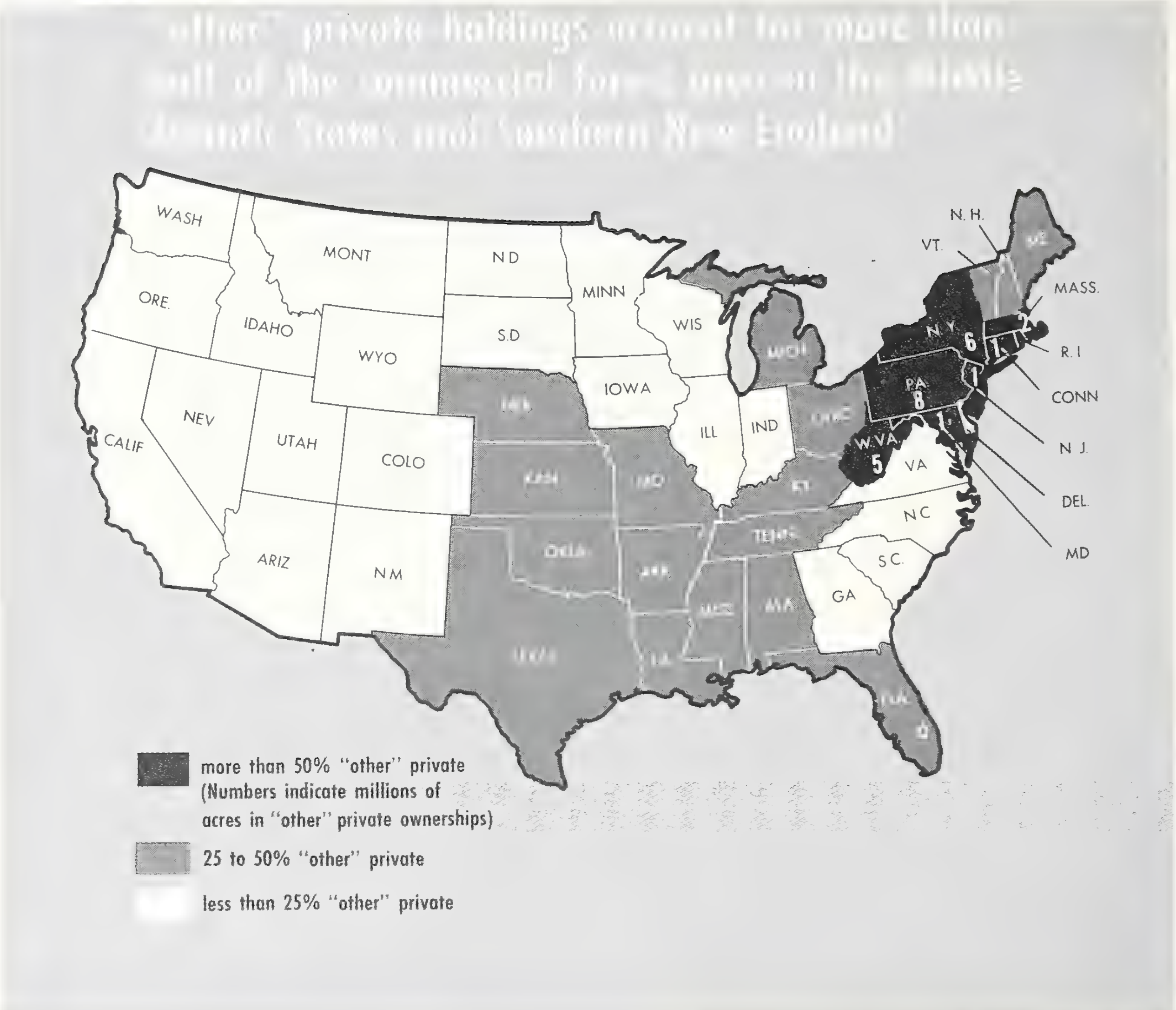


Figure 100

represent one-fourth of all commercial forest lands, or approximately as much as all public holdings combined.

Nearly half of the total acreage of farm ownerships is in holdings of less than 100 acres. An especially large proportion of 64 percent is found in the North and a low proportion of 14 percent in the West:

Size of farm holding (acres)	*United States (percent)*	*North (percent)*	*South (percent)*	*West (percent)*
Less than 100	47	64	41	14
100 to 500	36	32	39	32
500 to 5,000	14	4	16	41
5,000 to 50,000	3	(1)	4	9
50,000 and larger	(1)	----	----	4
Total	100	100	100	100

[1] Less than 0.5 percent.

The tabulation also shows that medium and large farm forest holdings of more than 5,000 acres are concentrated in the West.

In the case of "other" private holdings, about one-third of the total acreage is in ownerships of less than 100 acres:

Size of "other" private holding (acres)	United States (percent)	North (percent)	South (percent)	West (percent)
Less than 100	33	46	21	12
100 to 500	28	26	30	27
500 to 5,000	15	10	22	17
5,000 to 50,000	12	9	16	13
50,000 and larger	12	9	11	31
Total	100	100	100	100

As indicated in the tabulation, large and medium-size "other" private ownerships are found in all sections, with the West having the highest proportions in large ownerships.

Half the Farm and "Other" Private Ownerships Include 6 Percent of Commercial Forest Land

Ownerships of less than 30 acres number about 2.2 million, or half the total number of all farm and "other" private holdings, but these very small ownerships account for only 6 percent of the total area of commercial forest land:

Size of holding (acres)	Farm and "other" private ownerships, cumulative (thousands)	(percent)	Percent of total commercial forest land, cumulative
Under 10	796	18	1
Under 20	1, 660	37	4
Under 30	2, 240	50	6
Under 40	2, 608	58	9
Under 50	2, 962	66	12
Under 75	3, 475	77	18
Under 100	3, 864	86	25
All holdings	4, 487	100	61

The small size of farm and "other" private ownerships represents a real obstacle to attainment of intensive forest management. Incomes from small holdings are necessarily limited and usually infrequent. Small forests cannot support full-time timber managers and must of necessity be managed as sideline enterprises.

Where forestry assistance programs require personal contact with forest owners, problems arise because of the large number of owners and the relatively high cost per contact. When resources available for such assistance are limited, the question of priorities is of importance. Priorities might be given to areas of low productivity, for example, lands subject to accelerated erosion, or to softwood-producing lands. Forestry assistance programs might be made more effective by concentrating required personal contact on holdings above some minimum acreage.

Thus, if farm and other private holdings under 30 acres were excluded from the priority group of owners, half of all the farm and other private owners, or 2,240,000 holdings, could be left out with a loss of coverage of only 6 percent of the total commercial forest land. Some production from the smaller properties could be expected in any case, and concentration of efforts on the larger more productive holdings might significantly increase output.

Farm Forests Support Relatively Low Timber Volumes

The commercial forest land in farm ownerships comprises 34 percent of all commercial forest land but contains only 15 percent of the present sawtimber volume and 20 percent of the total growing stock (tables 168 and 169). On the average, farm ownerships support only 1,900 board-feet per acre, compared with 4,000 board-feet for "industrial and other private" holdings, and 4,200 board-feet for all ownerships. Although farm holdings in general are accessible and of relatively good timber-growing quality, they are in comparatively poor condition.

Information regarding timber volumes on "other" private lands is available only for the combined holdings of forest industries and other private owners, partly because of the difficulty of collecting accurate data and because differences in owner categories have only recently been considered of primary importance. These lands support considerably larger volumes on the average than do farm holdings, as already indicated. Industrial holdings are believed to support heavier volumes on the average than do "other" private holdings. But the fact that the latter

make up about two-thirds of the combined holdings suggests that they too support significantly heavier stands of sawtimber than do farm holdings.

Private Ownerships Are Heterogeneous

Farm forest owners engage in many types of crop and livestock farming. The miscellaneous "other" private owners vary even more as to occupation, residence, intent of ownership, and interest in forestry. Management decisions of these miscellaneous owners undoubtedly are affected by these factors, but which factors are of most importance from the standpoint of designing forestry programs is not fully known at this time.

Other Private Ownerships Represent Many Occupations

The diversity of occupations of "other" private forest landowners, as determined by independent ownership studies in a number of sample areas, is illustrated in table 177. Although definitions used in these studies differed somewhat and percentages consequently are not strictly comparable, in all of the areas studied business and professional people made up the principal class of "other" private owner in terms of forest area held. This was also frequently true in terms of number of owners. Included in business and professional classes were lawyers, teachers, physicians, merchants, sales-

TABLE 177.—*Distribution of number of "other" private owners of commercial forest land and of areas owned, by occupational groups, in selected areas of the United States* [1]

Occupational group	23 New England towns [2]		Tennessee Valley [3]		Central Mississippi [4]		5 areas in Arkansas, Louisiana, and Mississippi [5]		Northwest California [6]	
	Owners	Area	Owners	Area	Owners	Area	Owners	Area	Owners	Area
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Business and professional people	31. 3	36. 7	23. 5	35. 9	18. 4	48. 1	38. 6	51. 4	38. 5	68. 0
Wage and salary earners	27. 0	14. 5	50. 4	26. 4	57. 5	18. 5	24. 8	17. 2	22. 5	5. 8
Housewives	15. 1	10. 5	19. 3	15. 1	18. 0	23. 8	22. 9	17. 0	7. 2	2. 9
Retired persons	15. 4	16. 6	(7)	(7)	(7)	(7)	13. 7	14. 4	18. 5	9. 4
Dealers in forest land	4. 3	5. 5	(7)	(7)	1. 1	2. 8	(7)	(7)	(7)	(7)
Nonforest industries	1. 1	5. 9	1. 4	15. 1	(7)	(7)	(7)	(7)	(7)	(7)
Miscellaneous	5. 8	10. 3	5. 4	7. 5	5. 0	6. 8			13. 3	13. 9
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0
	Number	*Acres*	*Number*	*Acres*	*Number*	*Acres*	*Number*	*Acres*	*Number*	*Acres*
Size of sample	1, 387	160, 873	300	(8)	350	(8)	306	31, 507	(8)	(8)

[1] Excluding farm, forest industries, and unclassified ownerships.

[2] Source: *The Ownership of Small Private Forest-Land Holdings in 23 New England Towns*, by Solon Barraclough and James C. Rettie. U. S. Forest Serv. Northeast. Forest Expt. Sta. Paper 34. 1950. [Processed.] Limited to holdings of 10 to 12,000 acres of which only 3 were larger than 5,000 acres. The business and professional group included owners of recreational businesses, banks and other financial units, and students. Miscellaneous owners included clubs, institutions, and unsettled estates.

[3] Source: *Private Forest Management in the Tennessee Valley*, by Tenn. Val. Authority. Norris, Tenn. 1954. The business and professional group included mercantile, professional, and financial owners.

[4] Source: *Private Forest Landownerships and Management in Central Mississippi*, by Lee M. James, William P. Hoffman, and Monty A. Payne. Miss. Agr. Expt. Sta. Tech. Bul. 33. State College, Miss. 1951. Retired persons were included in other groups according to their former occupations. The miscellaneous group included unsettled estates, banks, churches, clubs, and unemployed workers.

[5] Source: *Private Forest Land Ownership and Management in the Loblolly-Shortleaf Type in Southern Arkansas, Northern Louisiana, and Central Mississippi*, by H. H. Chamberlin, L. A. Sample, and Ralph W. Hayes. La. Agr. Expt. Sta. Bul. 393. Baton Rouge, La. 1945. The business and professional group included teachers, lawyers, physicians, preachers, pharmacists, salesmen, bankers, and gasoline filling station operators. The area distribution was based on acreage of pine land owned rather than on total commercial forest land.

[6] Estimate obtained by combining statistics from *Ownership and Use of Forest Land in the Coast Range Pine Subregion of California* with statistics from *Ownership and Use of Forest Land in the Redwood-Douglas-Fir Subregion of California*, both by Adon Poli and Harold L. Baker. U. S. Forest Serv. Calif. Forest and Range Expt. Sta. Tech. Paper 2, 1953; and Tech. Paper 7, 1954. [Processed.]

[7] No separate estimate given. If identified, these ownerships might have been included in "Miscellaneous" occupational group.

[8] Not published.

men, bankers, owners of recreational resorts, and other businesses.

Wage earners constituted the second most important group of owners in most of the study areas. Housewives were third in importance in many areas. Retired persons likewise were of considerable importance, although the classification used in some studies did not include retirees as a separate group. Additional types of owners of varying local importance included public utilities, real estate dealers, various nonwood-using industries, estates, churches, clubs, institutions, etc. In some areas not considered in the studies referred to in table 177, it is known that mining companies, timber-growing enterprises, and railroads represent important types of "other" private owner.

Occupations of Most Private Owners Not Connected With Forestry

Most farm and "other" private owners are engaged in occupations not directly connected with timber growing. There are some exceptions, including timber holding companies and certain farmers and others who manage their land for timber crops which they sell as stumpage or round forest products to the forest industries. Some owners classed as farmers also operate small sawmills as a supplementary enterprise, or find part-time employment off the farm in forest industries. Thus, in the Mississippi study cited in table 177, 7 percent of the farmers, with 26 percent of the forest land in farm ownerships, either operated small sawmills or otherwise obtained a substantial share of their income from the sale of forest products during the year of the ownership survey.

According to data for a few sample areas, many farm and "other" private forest landowners do not recognize timber values as a primary reason for holding forest land, and to most of these owners timber growing is at best a sideline enterprise. Perhaps this is to be expected since most farm and other private owners earn their livelihood primarily in occupations outside the forest industries. Many owners have more than one reason for holding forest land. Some owners have difficulty in defining any reason at all.

In the New England study, timber values were recognized as one of the primary reasons for ownership by 65 percent of the farmers and only 35 percent of the "other" private owners. Recreation, satisfaction in owning land, residence, and speculation were all cited as important reasons for forest land ownership. In the Tennessee Valley, timber production was found to be of major or primary interest to only 3 percent of all private forest landowners, including a limited number of owners of wood-using plants. Thirteen percent of the owners cited interest in timber as equal to other interests, but, for more than 80 percent of the owners, interest in timber production was no more than secondary.

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Length of Tenure of Forest Land Varies Widely

The length of time land is held by a given owner varies widely. In the New England study, 23 percent of the farm and "other" private owners had held their property less than 3 years, and 41 percent less than 9 years. About one-third of all owners, with 42 percent of the acreage, had owned their land for more than 19 years. In the Tennessee Valley, only 19 percent of private forest owners had held their lands for 20 years or more.

Farmers Mostly Resident Owners: Many Other Owners Absentee

Most farmers and some "other" private forest owners reside on their forest properties, others live nearby, but many live at a considerable distance. In the New England study, for example, about half of all the private forest owners resided in the town where their forest property was located. These sample towns varied in total land area from about 5 to 70 square miles. In northwestern California, only 50 percent of the private commercial forest land was held by owners residing within the same county; 50 percent was held by owners residing outside the county, including 8 percent held by owners living outside the State.

Individual Ownerships Predominate

In the New England study, 93 percent of the private holdings (including lands of forest industries) were classed as individual ownerships; these represented 69 percent of the total forest acreage. Only 4 percent of the owners were corporations, including wood manufacturing companies, although these accounted for 28 percent of the total acreage. About 3 percent of the owners were classed as estates.

In the Arkansas-Louisiana-Mississippi area, 84 percent of the farm and "other" private owners were classed as individuals, 11 percent as estates, 3 percent as partnerships, and 2 percent as corporations. In some regions such as the Lake States, there are numerous hunting camps and other recreational properties in group ownerships, and some properties are held in undivided ownerships.

A significant number of owners are housewives, and some owners in other occupational groups are women. In the Arkansas-Louisiana-Mississippi study, for example, women made up 18 percent of the farm and other private owners, and their

holdings accounted for 12 percent of the total forest area.

With regard to age distribution, in the New England study 32 percent of the owners were more than 60 years of age. These older owners were concentrated in the retired and housewife groups. The age class of 40 to 60 years accounted for 55 percent of the owners. Those less than 40 years of age made up only 13 percent of all owners.

Both farm and other private owners obtain possession of forest lands chiefly by purchase. In the New England study, for example, 77 percent of the farm and 74 percent of other private owners acquired their lands by purchase, 24 percent by inheritance, and 1 percent by other means, chiefly foreclosures by banks and financial institutions. Inheritance and gifts were of especial importance in the case of housewives.

"Other" private ownerships thus include a wide variety of individual and corporate owners with widely differing characteristics. A more or less typical owner might be represented, for example, by a businessman who resides in a small city near a forest property that he purchased about 12 years ago for a combination of occasional timber income and recreational use.

Productivity of Farm and "Other" Private Forests Relatively Low

As a class, farm forests ranked lower than "other" private forests in productivity of recently cut lands. Ratings of 41 percent in the upper class, 37 percent in the medium class, and 22 percent in the lower class were, in fact, the lowest ratings of all the major types of owners, public or private (table 173, p. 303).

There were important regional differences in productivity of farm forests. Conditions following cutting were best on lands in the North, for example, and poorest in the South (table 178).

The proportion of recently cut lands in "other" private forests qualifying for the upper productivity class was greater than for farm forests, but still well below the average ratings for all public and forest industry holdings (table 173). Some 52 percent of the recently cut "other" private land was found to be in the upper productivity class, in contrast to 41 percent for farm holdings and 65 percent for all holdings. The proportion of area in the upper productivity class was highest in New England and California, lowest in the West Gulf, Southeast, Central, and Middle Atlantic Regions (table 178).

Productivity of farm and "other" private forests is in general related to size of holding. The relatively low productivity for these classes of ownership appears to be primarily attributable to the concentration of those lands in small and medium holdings. The "small" holdings of less than 5,000 acres show significantly smaller proportions of recently cut lands in the upper productivity class than the medium holdings, and these in turn show smaller proportions than the large holdings:

	Proportion of recently cut land in productivity class		
Ownership and size of holding (acres)	*Upper (percent)*	*Medium (percent)*	*Lower (percent)*
Farm:			
Small (less than 5,000)	40	38	22
Medium (5,000 to 50,000)	55	29	16
Large (over 50,000)	84	16	--
All holdings	41	37	22
Other private:			
Small (less than 5,000)	40	32	28
Medium (5,000 to 50,000)	56	31	13
Large (over 50,000)	69	21	10
All holdings	52	28	20

The conclusion that cutting of farm and other private forests generally results in low productivity is supported by evidence from some of the earlier surveys (table 177). In Arkansas, Louisiana, and Mississippi, for example, it was found that "current cutting practices have so depleted the forest capital on nonindustrial lands that they are producing only about one-third of their potential capacity." A study in the Tennessee Valley showed that only 2 percent of the farm forest land in that area was well managed.

Forestry Efforts by Farm and "Other" Private Owners Limited

In general, farm and "other" private forest owners are making no substantial investments in stand improvement on forest lands other than those recently cut. In the period 1947–53, only 2 percent of these owners were supplementing commercial logging by such measures as girdling or poisoning cull trees on such lands.

The level of fire protection achieved on many farm and "other" private holdings is considerably below the level reached on public holdings and forest industry lands. Although progress under the State-Federal cooperative fire control program in extending protection to private lands has been impressive in recent years, there remains an extensive acreage where fire protection is inadequate or where there is no organized protection at all. This is particularly the case in parts of the South and in the Central States where farm and other private ownerships include the bulk of the forest acreage.

Progress by farm and other private owners also has been made in connection with tree planting. In 1953, for example, more than 350,000 acres of farm and "other" private lands were planted. This was about half the acreage planted by all

TABLE 178.—*Productivity of recently cut lands in farm and other private ownerships in the continental United States, by section and region* [1]

Section and region	Farm ownerships—proportion of area by productivity class			Other private ownerships—proportion of area by productivity class		
	Upper	Medium	Lower	Upper	Medium	Lower
North:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
New England	42	39	19	74	19	7
Middle Atlantic	62	29	9	47	32	21
Lake States	59	29	12	66	25	9
Central	45	42	13	44	34	22
Plains	6	28	66			
Total	52	35	13	59	27	14
South:						
South Atlantic	45	38	17	60	32	8
Southeast	35	34	31	46	28	26
West Gulf	18	51	31	32	34	34
Total	34	38	28	44	30	26
West:						
Pacific Northwest	46	42	12	62	27	11
California	61	33	6	79	19	2
Northern Rocky Mountain	15	61	24	53	34	13
Southern Rocky Mountain	56	33	11	61	27	12
Total	46	42	12	62	27	11
Total, continental United States	41	37	22	52	28	20

[1] Recently cut lands (or operating area) in an ownership is the area of forest types in which there was some commercial cutting in the period 1947–54.

public and private owners. Since most of the 52 million acres of plantable land is in farm and "other" private holdings, however, it is evident that even tree planting is relatively limited in terms of need.

As in the case of industrial holdings, financial factors affect the forestry efforts of farm and "other" private owners. Federal income tax capital gains provisions afford favorable treatment to proceeds from sales of timber, but are often less well known to the smaller owners and therefore of less advantage to them. The impact of general property taxes on forest land and timber, while in general less burdensome during periods of rising prices, varies widely because of differences in local assessment practices. There is frequently a tendency for cutover lands and the poorer stands to be overassessed and for merchantable timber to be underassessed relative to other types of property. Yield taxes and other special forest tax laws designed to encourage the practice of forestry have proved effective in varying degree.

The credit needs of the smaller forest owners are being met only in part. Certain of the Federal Land Banks are active in making farm loans secured by forest land and timber for terms up to 40 years, and in areas where conditions are favorable such credit is increasing rapidly in volume. National bank loans on standing timber for terms up to 10 years, first authorized in 1953, are likely to be used by farm and "other" private owners to an increasing extent as this type of credit becomes better known.

VARIOUS REASONS GIVEN FOR POOR MANAGEMENT

Many reasons have been advanced to account for the relatively poor management of the 4½ million farm and "other" private holdings. These include a lack of knowledge of forestry opportunities and procedures and lack of interest in timber production. Many owners lack investment and operating funds for stand improvement, protection, taxes, and other carrying charges in the years when no sales are made.

The need for cash income often results in pressure to liquidate timber prematurely. Absentee ownership is associated with problems of supervision and risk of losing timber values. Relatively infrequent cutting is characteristic of most small holdings and long waiting periods for income are often necessary where properties are small or resources are depleted. Good markets for low qual-

ity timber and for small and irregular lots of timber products also are often lacking.

Frequently the owner himself cannot give a cogent reason for poor management, as illustrated in the Mississippi ownership survey (table 177). In this survey, all private owners whose forest management was rated poor, very poor, or destructive (accounting for 75 percent of the area in the sample) were asked to give a reason for their practices. Most of these owners did not recognize the fact that their management was poor and consequently could give no clear explanation. The explanations given included:

	Percent of forest area
Lack of interest in timber production	9
Present high prices preferred to uncertain prices of future	9
Immediate need of liquidating timber for cash	8
Belief that woods do not need care	7
Inability to supervise because of physical limitations or demands of more remunerative activity	3
Long period between incomes	3
Area too far away for constant supervision	3
Miscellaneous	2
Didn't know	56
	100

Little information is available on the relationships between intensity of forestry practices and ownership factors such as occupation, age, residence, intent of ownership, method of acquisition, or length of tenure. As previously indicated, productivity has been found to vary directly with size of holding—recently cut lands in large ownerships are significantly more productive than lands in medium-size holdings, and these in turn are more productive than recently cut lands in small holdings. There is little evidence available, however, to indicate what relationships exist, if any, between productivity and occupation or other owner characteristics.

Farm and "Other" Private Forests of Major Importance

In appraising the problems and opportunities for future timber supplies, it is evident that farm and miscellaneous private ownerships are of first importance. They represent 61 percent of all commercial forests. Because of their extent, potential productivity, and location with respect to markets, these lands should be expected to provide the greater part of the Nation's future timber needs. This will require solution of difficult problems, however. Most of these ownerships are of small size, productivity of recently cut lands is relatively low, and for various reasons management efforts are limited or lacking. Increasing the productivity of farm and "other" private holdings is a challenge for American forestry.

FEDERAL OWNERSHIPS

Federal holdings of commercial forest land total 103 million acres, or 21 percent of all commercial forest land (table 163, p. 291). The noncommercial forest land in Federal holdings aggregate about 110 million acres, or two-thirds of the 176 million acres of forest land that is unproductive for timber use or reserved for other purposes.

The national forests, administered by the Forest Service, U. S. Department of Agriculture, include 85 million acres of commercial forest land, or 17 percent of all commercial forests, and represent the largest public holding of commercial forest land. In addition, they have about a third of the noncommercial forests, including such types as pinyon pine-juniper, chaparral, and subalpine in the West, and unproductive muskeg and rocky areas in Coastal Alaska, as well as certain productive forest land reserved from timber use in wilderness and wild areas.

Federal lands administered by the Bureau of Land Management and other agencies in the Department of the Interior, the Department of Defense, and various "other" Federal agencies make up about 18 million acres, or 4 percent of the commercial forest land, plus about a third of the noncommercial forest area.

National Forests Established Largely From Public Domain

The forest reserves that were authorized by the Act of March 3, 1891, and designated as national forests in 1905, were formed by withdrawals of portions of the Federal public domain. By 1910, the national-forest system comprised about 168 million acres of such public-domain land. Subsequently, under the Weeks Law of 1911 as amended, the Federal Government purchased certain lands for the purpose of protecting watersheds of navigable streams and for the production of timber. In 1922 and 1925, Congress also provided for additions to the national forests through exchanges of public land or timber for private forest land. Donations for national-forest purposes were authorized in 1924.

By 1930, 3.7 million acres had been added to the national forests under these authorizations but, because of the elimination of rather substantial areas of public-domain land, the total acreage of national-forest land had declined to slightly less than 160 million acres.

Addition of land to the national forests was greatly accelerated during the depression years of

the 1930's, as shown in the following tabulation of net areas added to or eliminated from the national forests (including limited associated lands comprised of experimental and land-utilization areas):

Period (fiscal year):		Increase or decrease (−) (thousand acres)
1930–34		2, 841
1935–39		12, 892
1940–44		3, 051
1945–49		1, 839
1950	385	
1951	276	
1952	111	
1953	128	685
1954	−216	
1955	−55	
1956	56	
Total		21, 308

Much of the land added to the national forests in the depression years was by purchase. Such acquisitions, besides the basic purposes of watershed protection and timber production, was designed to aid forest landowners, minimize tax delinquency, and place cutover and depleted forest lands under stable management.

Areas acquired for national-forest purposes steadily declined after the depression, however, and in 1954 and 1955 statistics show a net decrease in the area of national forests and associated lands. In recent years, land has been added to the national forests primarily through land exchanges and transfers from other Federal agencies. Exchanges and transfers to other agencies have also accounted for most of the recent eliminations from the national forests and associated lands, as shown below:

	Thousand acres
Additions, fiscal years 1950–56:	
Reserved from public domain	44
Purchases	227
Exchanges—conveyed to United States	1, 077
Transfers—from other Federal agencies	373
Donations	6
Total	+1, 727
Net adjustments in acreages from new surveys, release of claims, etc	+102
Eliminations, fiscal years 1950–56:	
Returned to public domain	105
Sales, patents, and miscellaneous grants	124
Exchanges—conveyed by United States	455
Transfers—to other Federal agencies	460
Total	−1, 144
Net change, fiscal years 1950–56	+685

Although purchases were temporarily of large importance during the depression years, purchased land in the national forests as of June 30, 1956, amounted to only 10 percent of the total national-forest area. Lands acquired by exchanges of national-forest land or timber, transfers from other Federal agencies, or donations constituted 5 percent of the total:

Origin	June 30, 1929		June 30, 1956	
	Area (thousand acres)	Proportion (percent)	Area (thousand acres)	Proportion (percent)
Reserved public domain	156, 109	97. 7	153, 938	85. 0
Purchases	2, 996	1. 9	18, 397	10. 2
Exchanges	554	. 3	6, 727	3. 7
Transfers from other Federal agencies	100	. 1	1, 589	0. 9
Donations	2	------	408	0. 2
Total	[1] 159, 751	100. 0	[1] 181, 059	100. 0

[1] Includes experimental areas, and certain Bankhead-Jones Title III lands transferred to the Forest Service prior to January 2, 1954.

Lands originally acquired from the public domain thus still make up 85 percent of the national-forest area. They contain a considerably higher proportion of the timber volume in the national forests.

Purchases for national forests have been concentrated in the East, as shown in table 179, while land acquired by exchange has been located primarily in the West.

National-Forest Management for Multiple Use

The basic purpose in establishing the forest reserves, according to the Administration Act of 1897, was "to improve and protect the forest within the reservation, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States."

Subsequent legislation has also recognized the importance of continued use and conservation of all resources in the national forests—including water, timber, recreation, forage, wildlife, and minerals. Management of the national forests is thus geared to the concept of "multiple use" and "sustained yield" of all resources for the benefit of a wide variety of user groups.

Much land in the national forests is primarily suitable for public ownership because of the multiple values involved, including the predominance of water and the growing importance of recreation. In the western national forests are found the headwaters of all the major rivers that run through the various Western States. These public forests provide the water supply for some 1,800 cities and towns, more than 15 million acres of irrigated farmlands, and thousands of power plants and industrial installations. Management of national-forest lands for water production is of critical importance throughout both the West and the East to insure increasingly important supplies of usable water and to protect enormous investments in irrigation, power, and industrial developments.

The national forests also support hundreds of wood-using plants that ship lumber, plywood, and other forest products to all parts of the Nation.

Recreational resources in the national forests are enjoyed by a great variety of users who in 1954, for example, made more than 40 million visits to the national forests to enjoy the camping, fishing, hunting, and other recreational values of these public lands.

National Forests Include 37 Percent of Sawtimber Volume

The 85 million acres of commercial forest land in the national forests contain 766 billion board-feet, or 37 percent of the Nation's sawtimber resources (table 168, p. 298). In terms of softwoods, the national forests contain an even larger proportion—45 percent—of the present sawtimber inventory (table 169, p. 298). Sawtimber stands cover well over half of the commercial forest land in the national forests, including extensive areas of old-growth timber in the Western States.

Attention has frequently been directed to the large volume of old-growth timber remaining in the national forests. There are a number of reasons for this. For many years, most of the timber harvested for lumber, pulpwood, and other forest products was cut on private lands in the East. Western logging operations were also centered in private timber stands which were in general more accessible and of higher quality than the timber on those portions of the public domain which the Federal Government had retained in national forests.

Much of the land in the western national forests is in remote mountain areas of rough topography that were the last to be reached in the process of utilizing the Nation's old-growth timber resources. Roads suitable for timber utilization have generally been lacking, and this has meant that much national-forest timber has been beyond the economic reach of logging operators.

Until recent years, there was also little demand for national-forest timber because of the general availability of private timber. In addition, during the depression years of the 1930's there was considerable pressure from the timber industries to withhold national-forest timber from a market that was at the time oversupplied with privately owned timber.

In the Eastern States, most of the land acquired for national forests was of primary importance for watersheds or consisted of land that had been cutover and heavily burned. Thus, until recently these eastern forests also offered limited opportunity for commercial timber sales.

TABLE 179.—*Area of national-forest land in the United States, Coastal Alaska, and Puerto Rico, by origin, June 30, 1956*

Section and region	Total area	Reserved public domain	Purchases	Exchanges	Transfers	Donations
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
North:						
New England	957, 125		949, 181	3, 677		4, 267
Middle Atlantic	1, 373, 826		1, 372, 603	1, 040		183
Lake States	6, 742, 024	1, 151, 349	4, 531, 375	1, 037, 006	18, 857	3, 437
Central States	2, 257, 927	2, 486	2, 192, 346	46, 356	16, 659	80
Plains	1, 326, 045	1, 264, 800	666	60, 227	91	261
Total	12, 656, 947	2, 418, 635	9, 046, 171	1, 148, 306	35, 607	8, 228
South:						
South Atlantic	3, 156, 519		3, 034, 540	78, 790	42, 234	955
Southeast	3, 998, 704	187, 338	3, 304, 975	87, 948	417, 164	1, 279
West Gulf	3, 762, 998	951, 987	2, 576, 357	105, 100	127, 776	1, 778
Total	10, 918, 221	1, 139, 325	8, 915, 872	271, 838	587, 174	4, 012
West:						
Pacific Northwest	24, 511, 690	22, 183, 157	52, 335	1, 653, 634	581, 121	41, 443
California	19, 958, 467	18, 489, 278	160, 005	1, 227, 329	61, 603	20, 252
Northern Rocky Mountain	45, 476, 709	43, 882, 899	41, 503	1, 177, 024	64, 441	310, 842
Southern Rocky Mountain	46, 762, 968	45, 072, 257	167, 323	1, 248, 690	252, 701	21, 997
Total	136, 709, 834	129, 627, 591	421, 166	5, 306, 677	959, 866	394, 534
Coastal Alaska	20, 740, 612	20, 740, 342		263		7
Puerto Rico	33, 068	12, 384	14, 065		5, 157	1, 462
All regions	181, 058, 682	153, 938, 277	18, 397, 274	6, 727, 084	1, 587, 804	408, 243

From the beginning of World War II, demands for public timber increased rapidly, and the volume of timber cut on the national forest has risen steadily. In fiscal year 1956, the cut of national-forest timber reached 6.9 billion board-feet, or 3⅓ times the cut of 2.1 billion board-feet in 1940. Present national-forest policies provide for bringing the cut of national-forest timber up to the maximum level possible under sustained-yield management.

In the decades ahead, national-forest timber will, and should, comprise a more important segment of the raw material for forest industries, in view of the volume and quality of these resources. In addition, on private timberlands in industrial holdings, the cut is often limited because of reduced growing stocks or efforts to build up a permanent timber supply. To the extent possible and within limits of sustained-yield capacity, cutting in old-growth stands in the western national forests should sustain a substantial part of the forest industries until sufficient young-growth timber matures on private lands to permit cutting in balance with productive capacity on both private and Federal lands.

National Forests of Major Importance in West

The national forests are of major importance in the western economy since they account for 52 percent of all the commercial forest land in the Western States and 48 percent of the present volume of sawtimber in the West. Nearly 61 million acres, or 72 percent of the 85 million acres of commercial forest land in all of the national forests, is in the western regions (table 180). National forests in both the North and South contain about 10 million acres of commercial forest land and in Coastal Alaska about 3½ million acres. In terms of sawtimber, the western national forests are of even larger importance than the eastern forests, with 646 billion board-feet, or 84 percent, of all national-forest sawtimber.

As indicated previously, areas of old-growth timber in the western national forests have not as yet been opened up for utilization and management. Access road construction and maintenance is of particular importance as a means of lessening the volumes of overmature timber lost annually to insects and other destructive agents and bringing the cut into line with sustained-yield capabilities.

Management of National Forests Becoming More Intensive

On recently cut national-forest lands, productivity for future timber crops is relatively good, averaging 81 percent in the upper productivity class, 16 percent in the medium class, and only 3 percent in the lower class (table 173, p. 303).

Table 180.—*Area of commercial forest land and volume of timber in the national forests, in the United States and Coastal Alaska, by section and region, 1953*

Section and region	Commercial forest land	Sawtimber	Growing stock
	Thousand acres	*Million bd.-ft.*	*Million cu. ft.*
North:			
New England	822	2, 310	1, 038
Middle Atlantic	1, 339	1, 691	903
Lake States	5, 895	5, 652	3, 199
Central and Plains	2, 226	3, 454	1, 186
Total	10, 282	13, 107	6, 326
South:			
South Atlantic	2, 783	6, 258	1, 961
Southeast	3, 892	8, 210	2, 404
West Gulf	3, 697	8, 748	2, 379
Total	10, 372	23, 216	6, 744
West:			
Pacific Northwest	17, 109	308, 907	59, 694
California	8, 573	178, 913	32, 086
Northern Rocky Mountain	21, 627	108, 232	28, 378
Southern Rocky Mountain	13, 351	50, 476	12, 732
Total	60, 660	646, 528	132, 890
Coastal Alaska	3, 445	82, 524	17, 139
All regions	84, 759	765, 375	163, 099

Over the years, fire protection has been extended to all national-forest lands, and in 1952 protection was considered adequate for average years on 89 percent of the total area requiring protection. Areas burned have been steadily reduced and in 1952, for example, the area burned amounted to 0.1 percent of the total area protected. Control of insects, diseases, and other pests also has been strengthened. Through aerial spraying to control defoliators in spruce and pine timber, for example, a good beginning has been made in reducing the great losses of timber caused by epidemics of insects.

Some of the nonstocked national-forest lands also have been planted, although the rate of planting is still relatively low. In 1953 planting on national forests amounted to 53,000 acres, or 7 percent of the total planting by all agencies. The area of successful plantations in the national forests totaled 1.4 million acres, or 27 percent of all acceptable plantations in the United States. About 4.6 million acres, however, are still classed as plantable.

Adjustments in National-Forest Areas

The system of national forests, initiated more than 60 years ago, is believed to have stood the test of time. Intermittently questions have been raised as to whether it is desirable public policy to continue a system of national forests or to dispose of all or substantial portions of these lands to individuals or to State or local governments. However, the continuing policy of the Executive Branch and the Congress, since establishment of the national forests, has been one of strong support.

At the same time, with changing conditions, land policies need to be adjusted to meet new economic or social situations. The boundaries of the national forests, for example, should be subject to continuing scrutiny and adjustment which will facilitate more efficient management of both public and private land holdings. There are also situations where certain national-forest lands should be offered for sale to private ownership, as for example small isolated tracts or narrow projecting strips largely outside established boundaries, lands immediately adjacent to urban areas, or tracts suitable for townsites, when such lands are suitable for private ownership and better adapted to such purposes than to national-forest uses.

Exchanges of national-forest land for other public or private land, and transfers of land between public agencies, also offer opportunities for bringing about more efficient administration of both national forests as well as other private or public land holdings. Subject to such adjustments, it is believed that the national-forest system is sound and that its continuation and further development is desired by the American people.

The commercial timberlands in the national forests can play an increasingly important role in furnishing the Nation with continuous supplies of timber products of desirable kinds and quality, sustaining forest industries and communities, providing a steady employment base often in areas of underemployment, helping the Nation meet possible emergency needs, managing areas for demonstration of timber-growing practices, and providing leadership and stimulus to private forest-land management. In recent years, the national forests have furnished about 10 percent of the Nation's total sawtimber cut. Through intensive management these public lands have the potential to provide a larger base for forest industries and an increased share of the Nation's timber needs.

Other Federal Lands Contribute to Timber Supply

The 18.4 million acres of commercial forest land under Federal administration other than in national forests represent about 4 percent of the commercial forest area (table 163, p. 291). Federal agencies other than the Forest Service also administer about one-third of the noncommercial forests, including both productive lands reserved from timber use in the national parks and large areas of open woodland and other types of limited commercial value for timber.

Areas administered by the Indian Service, comprising 7 million acres of commercial forests, are included with other Federal holdings because of their Federal administration. These lands are not strictly Federal lands but are held in trust status on a temporary basis pending ultimate disposal to the Indians. Most of the Indian lands are located in the western regions and the Lake States (table 181).

Commercial forest lands administered by the Bureau of Land Management, totaling 6.3 million acres, include 2.1 million acres of valuable timber lands in the reconveyed Oregon and California and Coos Bay land grants in western Oregon, plus scattered forested areas located chiefly on the vacant, unappropriated, and unreserved public domain in the Western States and Coastal Alaska. These vacant public-domain lands under certain conditions are subject to sale or other disposal to private ownership.

The 5 million acres of commercial forest land in Federal holdings, other than the national forests or lands administered by the Indian Service and the Bureau of Land Management, are largely in military reservations, game refuges, land-utilization areas, and reclamation, flood control, and power development areas. These lands are concentrated in the South, but substantial areas are also located in the North.

Federal lands other than the national forests support relatively heavy volumes of sawtimber, aggregating 135 billion board-feet, or nearly 7 percent of the total sawtimber resource (table 168, p. 298, and table 181). Approximately 56 percent of these lands support sawtimber stands, or nearly the same proportion as the national forests support (table 167, p. 296). Growing stock totals 28 billion cubic feet, or 5.4 percent of the Nation's total (table 169, p. 298, and table 181). These timber volumes, as in the case of area, are largely concentrated in the western regions.

Management of Federal Lands Relatively Good

The productivity of recently cut lands in the various classes of Federal holdings other than the national forests averages about the same as on the national forests—close to 80 percent in the upper productivity class, and only about 3 percent in the lower productivity class (table 173, p. 303). This is considerably better than the average for all forest land holdings.

TABLE 181.—*Area of commercial forest land and volume of timber in Federal holdings other than national forests, in the United States and Coastal Alaska, by section and region, 1953*

Section and region	Commercial forest land				Sawtimber	Growing stock
	Total	Indian [1]	Bureau of Land Management [1]	Other		
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Million bd.-ft.*	*Million cu. ft.*
North:						
New England	82			82	122	55
Middle Atlantic	202			202	266	155
Lake States	1, 645	1, 119	67	459	2, 538	1, 069
Central and Plains	883	369	5	509	1, 334	599
Total	2, 812	1, 488	72	1, 252	4, 260	1, 878
South:						
South Atlantic	701	47		654	1, 547	470
Southeast	2, 345	46	28	2, 271	4, 370	1, 262
West Gulf	778	24	126	628	1, 254	381
Total	3, 824	117	154	3, 553	7, 171	2, 113
West:						
Pacific Northwest	5, 541	2, 763	2, 660	118	90, 175	17, 201
California	497	133	324	40	10, 156	1, 825
Northern Rocky Mountain	2, 111	822	1, 206	83	7, 113	1, 870
Southern Rocky Mountain	2, 775	1, 622	1, 097	56	10, 034	2, 014
Total	10, 924	5, 340	5, 287	297	117, 478	22, 910
Coastal Alaska	805	20	785		6, 212	1, 290
All regions	18, 365	6, 965	6, 298	5, 102	135, 121	28, 191

[1] Because of different definitions of commercial forest land, figures for these ownerships may vary from published figures of the public agencies concerned.

Fire protection in the United States and Coastal Alaska has been extended to all but 3 percent of the commercial and noncommercial forest lands in Indian holdings, essentially all of the forests administered by the Bureau of Land Management, and all but 7 percent of the "miscellaneous" Federal holdings. On 71 percent of the total forest area of these Federal holdings, protection is considered adequate in average years. In 1952 the area burned on Federal lands other than the national forests averaged about 0.3 percent of the area needing protection.

Tree planting on Federal holdings other than national forests covered about 24,700 acres in 1953, or 3 percent of the area planted by all agencies. Roughly a million acres of these Federal lands is considered plantable commercial forest land.

STATE AND LOCAL PUBLIC OWNERSHIPS

Commercial forest lands owned by the States comprise 19.2 million acres, or 4 percent of the total commercial forest land (table 163, p. 291, and table 182). Most of these State holdings—65 percent—are located in the Northern States, chiefly in Michigan, Minnesota, and Pennsylvania. About 25 percent of the State lands are found in the West, mainly in Washington, Idaho, Oregon, and Montana. About 10 percent are located in the South.

County holdings total about 7 million acres of commercial forest land, and municipal and other local public holdings about 1 million acres, or a combined total of 1.6 percent of all commercial forest land. More than 80 percent of these holdings are located in the North, chiefly in Minnesota and Wisconsin.

PRESENT TIMBER VOLUMES RELATIVELY LOW

The commercial forests in State and local public ownerships include some well-timbered areas, particularly in the West, but on the average are not as well stocked as the forests held by other owner classes. Thus the State-owned lands account for 3.9 percent of the commercial forest land but only 3.1 percent of the sawtimber volume (table 163, p. 291, and table 168, p. 298).

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TABLE 182.—*Area of commercial forest land and timber volume in State, county, and municipal ownerships, in the continental United States, by section and region, 1953*

Section and region	Commercial forest land		Sawtimber		Growing stock	
	State	County and municipal	State	County and municipal	State	County and municipal
	Thousand acres	*Thousand acres*	*Million bd.-ft.*	*Million bd.-ft.*	*Million cu. ft.*	*Million cu. ft.*
North:						
New England	580	257	677	332	474	204
Middle Atlantic	3, 645	328	5, 054	343	2, 539	218
Lake States	7, 747	6, 152	4, 368	2, 661	2, 953	1, 972
Central and Plains	574	49	944	141	336	36
Total	12, 546	6, 786	11, 043	3, 477	6, 302	2, 430
South:						
South Atlantic	450	82	917	178	257	61
Southeast	1, 017	535	1, 329	968	469	372
West Gulf	390	9	791	19	220	5
Total	1, 857	626	3, 037	1, 165	946	438
West:						
Pacific Northwest	2, 636	505	32, 853	6, 908	6, 579	1, 340
California	186	8	4, 547	195	827	34
Northern Rocky Mountain	1, 564	79	11, 832	123	2, 685	39
Southern Rocky Mountain	380	43	832	40	275	17
Total	4, 766	635	50, 064	7, 266	10, 366	1, 430
Total, continental United States	19, 169	8, 047	64, 144	11, 908	17, 614	4, 298

County and municipal boldings make up 1.6 percent of the commercial forest area but only 0.6 percent of the sawtimber volume. Only 16 percent of the State and local public holdings support sawtimber stands, or far less than the average of 37 percent for all ownerships (table 167, p. 296). The proportion of nonstocked areas—16 percent—is about double the proportion for all forest ownerships.

The forest lands owned by States and counties in the East were largely acquired through tax delinquency and purchase, while in the West the State lands to a large extent represent the remnants of land grants received from the Federal Government. Considerable portions of the 6 million acres of noncommercial forest lands in State and local public ownerships have been reserved by State and local governments for recreational purposes, notably including the New York State Forest Preserve and scattered parks in various other States.

Management and Protection Efforts Increasing

About 77 percent of recently cut State lands qualified for the upper productivity class compared with 76 percent for county lands and 93 percent for municipal and other public holdings (table 173). About 5 percent of the State lands and a negligible proportion of other recently cut local public lands were in the lower productivity class.

Fire protection is relatively good on State and local public holdings. About 76 percent of the total area of commercial and noncommercial forest land is given adequate protection in average years, and only 7 percent of the total area is without organized fire protection. Areas burned in 1952 averaged 0.8 percent of all forest lands owned by the States and local public agencies.

The tree planting record of State and local public agencies has also been relatively good and these agencies now have a total of 1.2 million acres of plantations. In 1953, about 64,000 acres of land were planted, or roughly 9 percent of the total plantations established. It is estimated that an additional 2.6 million acres are suitable for planting.

State and Other Public Holdings Important Locally

Though constituting a relatively small part of the total commercial forest land, State and local public holdings have an important place in the

future timber-supply picture for a number of the States. In addition, State agencies play a major role in forestry programs on private lands throughout the country.

As in the case of Federal lands, multiple uses—timber, recreation, game, and water—are important on a large part of the State and local public forest lands. Many of these holdings, particularly in the East, have been placed under permanent administration in organized State or county forests, although other areas are not specifically managed or are available for sale to private owners. Considerable areas of scattered tracts, especially in the West, are administered by State Land Boards. In some cases, State and county lands are too scattered for efficient management and there is need to consolidate certain holdings for more effective management.

KEY PROBLEMS OF OWNERSHIP

Review of forestry progress clearly indicates that the greatest advances in protection and management of commercial forest land and timber resources have been made on the holdings of the forest industries and public agencies. Together these ownerships represent 39 percent of all commercial forest lands. The poorest forest conditions and the most difficult problems of ownership are found on the small holdings of farmers and "other" private owners, many of whom hold their lands primarily for purposes other than timber growing. In the aggregate, these farm and "other" private ownerships include 61 percent of the Nation's commercial forests. For many years they have supplied a large proportion of the logs, pulpwood, and other raw material used by forest industries.

If prospective timber requirements are to be met, it is evident that most private and public forest holdings must yield substantially more timber than is presently grown or cut from these lands. There are various reasons for the lack of management on most forest properties, some of which are technical, some economic, and some psychological in nature.

In recognition of the complexity of forestry problems, a variety of programs have been developed in the United States aimed at improving the protection and management of both private and public forest lands. In developing new or more adequate programs to meet current problems and changing conditions in the future, facts of forest ownership will be of key importance. Landowners' decisions are influenced by various factors, most of which are of undetermined importance. Difficult policy questions relating to ownership are necessarily involved in appraising the need for program modifications, some of which represent broad issues that extend far beyond the limits of forestry.

As an illustration of these problems of ownership, the question is frequently raised as to what is a desirable balance between public and private ownership, and between various classes of private and public holdings. Part of this question involves the extent to which large forest industries should further expand their holdings of commercial forest land through purchase and consolidation of small private ownerships.

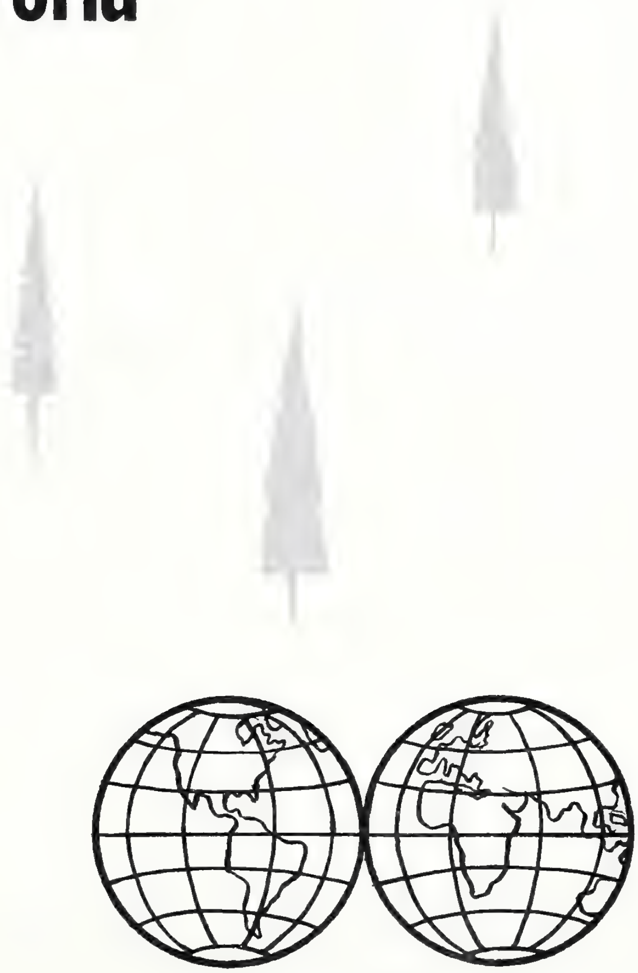
In connection with programs of assistance to landowners, another important question relates to the possible limitation of available funds and manpower to assist selected classes of owners, such as owners of the better forest lands, particular types of owner, or owners of the larger holdings who in general have been more responsive to forestry programs than owners of small holdings. By concentrating programs on owners of more than 30 acres of commercial forest land, for example, half of all farm and miscellaneous "other" private holdings might be eliminated with a loss of coverage of only 6 percent of the total commercial forest land area.

Another continuing question relates to the desirable intensity of management of public forests and the balance that should be maintained between timber and other alternative uses of public lands.

As a final illustration of the problems of ownership, the question is often posed as to the degree of responsibility forest industries should assume for improving the cutting practices of woods operators cutting on the lands of farmers and miscellaneous "other" private owners.

These are a few of the questions pertaining to ownership that must be appraised, tentatively answered, and continuously studied in formulating and executing programs for American forestry.

Timber Resources of North America and the World



CONTENTS

TIMBER RESOURCES OF NORTH AMERICA AND THE WORLD[52]

INTRODUCTION

Any realistic appraisal of the future timber supply situation of the United States must consider the forest resources in Interior Alaska,[53] Canada, Mexico, and more remote parts of the world that might carry on timber trade with the United States. Accordingly, this section will review briefly the timber resources of North America and the world, emphasizing the relationship of those resources to comparable resources in the United States and to possible United States import and export opportunities. This discussion is oriented mainly with respect to the Free World because trade barriers between the nations of the Free World and the Communist nations must be faced. Until normal trade between these two groups is resumed, the considerable supply of softwood timber in the U. S. S. R. and associated countries is largely unavailable to the Free World. For present purposes, it seems safer to consider the timber supplies of the Free World alone, with reference to timber supplies in Communist countries mainly for comparative purposes. If, at a later date, Communist timber resources become freely available in international trade, the needs of some of the timber importing nations can be met more easily.

In appraising the world timber supply situation, it must also be recognized that the knowledge of the forest resource in only a few countries is based on statistically reliable field surveys. In many countries, accounting for considerable timber volume, the only available data are estimates made by experienced technicians acquainted with the local conditions.

INTERIOR ALASKA'S TIMBER SITUATION

Future development of Alaska's vast Interior (fig. 101) is endangered by forest fires which have burned an average of over a million or more acres every year since 1940. Almost every acre in the Interior has been burned at one time or another, yet there is a forest resource of at least 180 billion board-feet on 40 million acres of commercial forest land. Even under the reduced growth caused by fire, insects, and diseases, there is an estimated net yearly growth of almost four billion board-feet. Alaskans now use only three-tenths of one percent of this, yet they import annually some seven million dollars' worth of wood and wood products. The development of forest industries in the Interior would do much to reduce the import and would contribute to the industrial growth and economic development of the Territory. The forests under adequate protection are capable of supporting substantial forest industries, as do somewhat similar forests of southern Canada and northern Maine.

Forests Cover More Than One-Third of Interior Alaska

Alaska's interior forests cover almost 120 million acres, or 35 percent of the total land area. Roughly, another third consists of grassland, brush, swamps, and tundra, with a small fraction in agricultural crops. The balance is barren rock or ice and snow, largely at high elevations. The land area of Interior Alaska by major classes of land is as follows:

	Area	
	Thousand acres	*Percent*
Forest land:		
Commercial	40, 000	12
Noncommercial	79, 700	23
All forest land	119, 700	35
Nonforest land:		
Agricultural cropland in use	10	----
Possible cropland, not used	3, 850	1
Grassland	23, 140	7
Brushland	23, 000	7
Swamps and tundra	62, 200	18
Barren, rocks, ice	99, 000	29
All nonforest	211, 200	62
Total land area	330, 900	97
Water (rivers and lakes)	8, 790	3
Total area Interior Alaska	339, 690	100

[52] Authors who participated in the preparation of this section are George F. Burks, I. Irving Holland, Karl R. Mayer, Ray F. Taylor, and Robert K. Winters, all of the Forest Service. R. R. Robinson, Bureau of Land Management, Department of the Interior, collaborated in preparing the report on Interior Alaska.

[53] The forest resources of other United States territories and possessions—the Commonwealth of Puerto Rico, the Virgin Islands, Hawaii, and Guam—while of local importance are not large enough to have any overall effect on the United States situation.

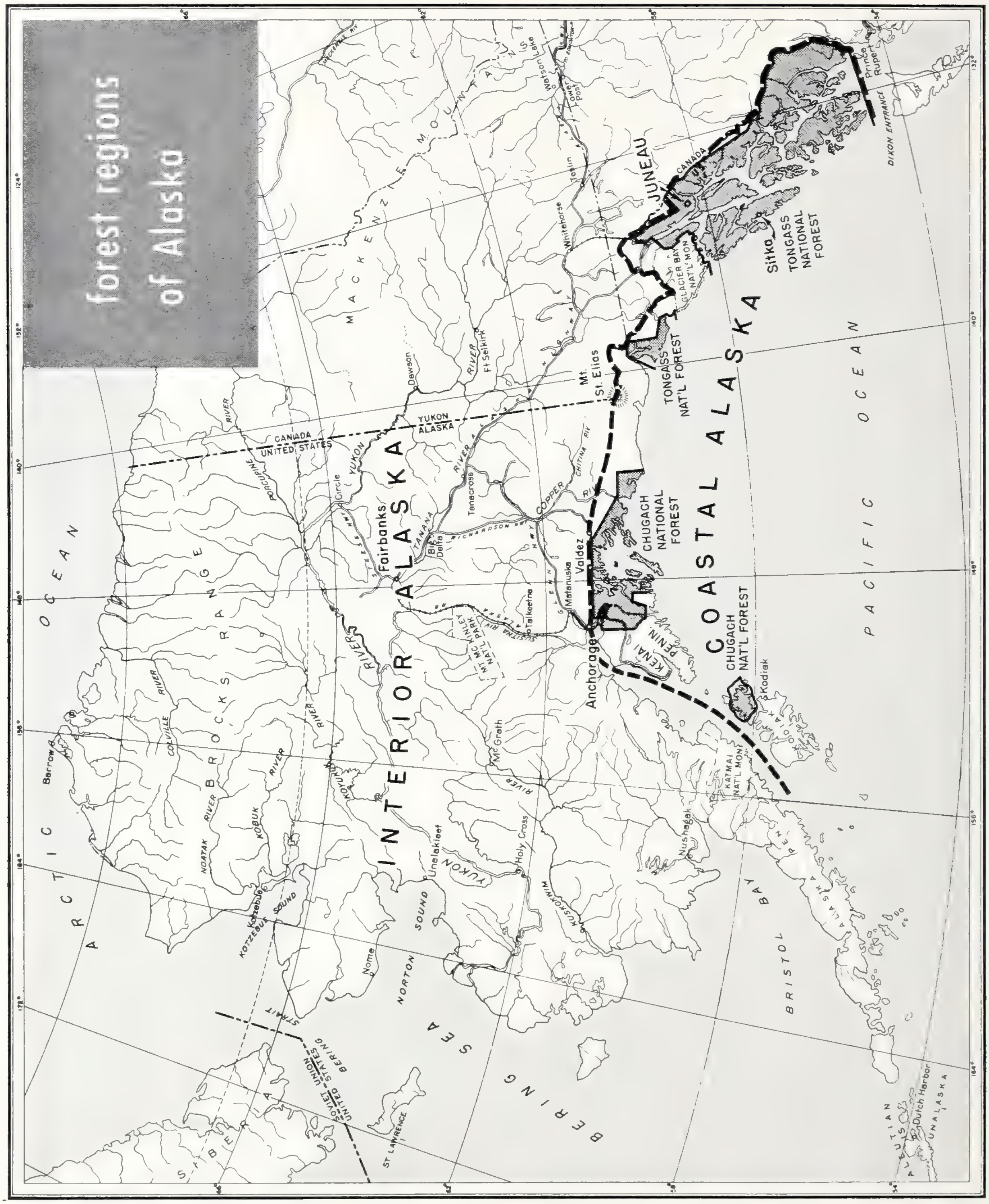

forest regions of Alaska
INTERIOR ALASKA
COASTAL ALASKA
TONGASS NATIONAL FOREST
TONGASS NAT'L FOREST
CHUGACH NATIONAL FOREST
CHUGACH NAT'L FOREST
GLACIER BAY NAT'L MON
KATMAI NAT'L MON
MT. MC KINLEY NAT'L PARK
JUNEAU
Sitka
Anchorage
Fairbanks
Valdez
Kodiak
Nome
Barrow
Kotzebue
Circle
Big Delta
Tanacross
Matanuska
Talkeetna
McGrath
Holy Cross
Unalakleet
Nushagak
Dutch Harbor
Prince Rupert
Dawson
Ft Selkirk
Whitehorse
Teslin
Watson Lake
Lower Post
Mt. St. Elias
CANADA
UNITED STATES
YUKON
ALASKA
SOVIET UNION
UNITED STATES
ARCTIC OCEAN
PACIFIC OCEAN
BERING SEA
BRISTOL BAY
NORTON SOUND
KOTZEBUE SOUND
BERING STRAIT
BROOKS RANGE
MACKENZIE MOUNTAINS
KENAI PENIN
SIBERIA
ST LAWRENCE
UNALASKA
DIXON ENTRANCE
YUKON RIVER
KOYUKUK
TANANA
COPPER RIV
CHITINA RIV
PORCUPINE RIVER
COLVILLE RIVER
NOATAK RIVER
KOBUK RIVER
KUSKOKWIM RIVER
SUSITNA RIV
RICHARDSON HWY
GLENN HWY
STEESE HWY
ALASKA

Figure 101

The forests extend to the Arctic tundra, the dense stands being largely confined to the lower slopes of the larger river valleys and their main tributaries. The more open woodlands, or sparse forests of the same species (white spruce and birch) reach up the slopes to timberline and extend over the higher plateaus. Over 99 percent of the Interior, forested as well as nonforested, is under the jurisdiction of the U. S. Department of the Interior's Bureau of Land Management.

Forty Million Acres of Commercial Forest Land

Land not good enough for producing agricultural crops, but either producing or capable of producing forest stands having 5 thousand board-feet of timber in trees 11 inches and larger in diameter, is considered as commercial forest land. Forty million acres of such land or an area almost as large as the commercial forest land area of the Lake States extends along the river valleys and lower slopes of these drainages. The sparse or open woodlands, presently considered noncommercial, cover almost 80 million acres. The principal forested regions include the following: The Copper River and its many large tributaries, the Matanuska River, the Susitna River and its tributaries, upper Cook Inlet and the Iliamna Lake, Lake Clark and Nushagak River sections, the Kuskokwim, Tanana, and Yukon River regions. It is noteworthy that considerable areas of forest land, much of it commercial, occur north of the Arctic Circle, for example on the Porcupine River and its tributaries, the Chandalar, and the Upper Koyukuk Rivers. Tree growth is known to occur well north of latitude 68° N. on the south slopes of the Brooks Range and as far west as the Niukuk River, near Council, on the Seward Peninsula. This latter station is the westernmost occurrence of forest growth on the North American Continent.

Land other than that forested, comprising some 211 million acres or 62 percent of the total, consists of 29 percent swamps and tundra, 47 percent barren mountaintops, 11 percent brushlands, 11 percent grass, and the balance, a mere 2 percent or 3.9 million acres, is considered to be of possible agricultural value. As no land classification has been completed, there is a diversity of opinion as to the amount that could be called cropland.

In 1950, according to the Census of Agriculture, there were about 10,000 acres of cropland in farms in the Territory, but only 6,500 acres harvested. Agricultural land is almost nonexistent in the coastal area; hence, most of this cropland lies within the Interior. Of the 40 million acres of commercial forest land 14 million are in areas being used for producing lumber, house logs, and fuelwood. Much of the remaining 26 million acres is fairly accessible to rivers or other travel routes, but lies beyond the range of present use.

According to the estimate in the following tabulation, 95 percent of the commercial forest land is in public ownership; that is, it is either vacant, unreserved public domain, or controlled by the Government as a War or Navy Department reservation, a wildlife preserve, national park or monument.

	Commercial forest land area of Interior Alaska, 1953	
	Thousand acres	*Percent*
Public	37, 870	94. 7
Institutions:		
Religious	27	. 1
University and Indian schools	103	. 2
Total	130	. 3
Private:		
Industrial (mining corporations, canneries, etc.)	500	1. 3
Farms (includes homesteads)	1, 000	2. 5
Small tracts, public service sites, homesites, etc	500	1. 2
Total	2, 000	5. 0
All ownerships	40, 000	100. 0

About 40,000 acres of commercial forest land in public ownership is reserved under authority of the Department of the Interior to provide an assured and stable supply of products for certain settlements.

Institutional ownership represents less than 1 percent of the total. The portion now held by religious institutions stems from original grants to them by the former owners of Alaska—Russia.

Private ownership of commercial forest land by individuals and corporations amounts to about 5 percent of the total. Half of this area is found on farms and homesteads. As shown in the following tabulation, private land is held primarily in small ownerships, 80 percent of the total being in tracts of 1,000 acres or less.

	Private commercial forest land area in Interior Alaska, 1953	
Ownership size class:	*Thousand acres*	*Percent*
Less than 1 acre	5	0. 2
1–5 acres	20	1. 0
5–100 acres	475	23. 8
100–1,000 acres	1, 100	55. 0
More than 1,000 acres	400	20. 0
Total	2, 000	100. 0

The Forests Are Chiefly White Spruce and Birch

Fortunately, after fire, much of the forest land in Alaska returns to commercial tree species unless it has been so severely burned as to prevent regeneration of trees. White spruce and white birch, also natives of northern Maine, the Lake States, and Canada, in their westward extension

to Alaska are not accompanied by such weed species as gray birch or red maple. Seen from the air the forest and other vegetation cover appears as a complex mosaic of types. In general, the forest occupies the valleys, often appearing as belts which follow the meanders of the streams, and the lower slopes and low benchlands. Throughout most of the region timberline is comparatively low, between 2,000 and 3,000 feet elevation.

The complexity of the vegetation pattern is, in large measure, the result of fire. Only when the influence of past fires is appreciated can one begin to account for the seemingly haphazard distribution of vegetation types. The sharp boundaries between stands of quaking aspen or Alaskan white birch and white spruce are then recognized as the edges of burns. Isolated stands of a few acres of white spruce, the upland stringers, and even the scattered trees of white spruce may also be recognized as remnants or relics of former extensive stands that have been destroyed by fire. Some areas, now treeless, on close examination prove to have formerly supported full forest stands which were destroyed by repeated burning.

Another influence that contributes to the diversity of vegetation cover is the occurrence, in somewhat complicated pattern, of permanently frozen ground. This phenomenon frequently results in poor soil drainage with the attendant evils of poor soil aeration, restricted root space, and low soil temperatures. Within the Alaskan Interior, either greatly impeded drainage (whether associated with permanently frozen ground or not) or very excessive drainage lead to outstandingly poor sites for tree growth.

Sharp boundaries between vegetation types are most frequently caused by fire whereas those caused by topography and associated influence are apt to be diffuse.

No reliable information is available as to the relative areas of individual softwoods (white spruce, black spruce) or of hardwood species (white birch, cottonwood, and aspen). It has been roughly estimated that about 55 percent of the commercial forest land has coniferous cover, 17 percent has a cover of broadleaved trees and the balance—28 percent—is a mixture of broadleaved species and conifers, having a ratio of 60 percent softwoods and 40 percent hardwoods. The 40 million acres, when broken down in this way, are composed of 29 million acres of softwoods and 11 million acres of hardwoods.

Following are the recognized forest types of Interior Alaska. Their characteristics are somewhat at variance with similar types farther east. The white spruce and the white birch types and their mixtures comprise the bulk of the commercial forest on the better sites. Aspen and tacamahac poplar (balsam poplar) also form merchantable stands. Black spruce usually becomes of merchantable size only when it invades better drained areas on uplands.

1. *White spruce is the climax forest community* on upland areas of the Interior. The essentially pure stands are broken by areas of white birch or aspen or types transitional between these and pure spruce. A stand may be even aged or many aged, depending on whether it started as a seedling stand or by gradual entry into a paper birch or aspen overstory. Average maximum heights at maturity (about 160 years) are 85–100 feet, and average maximum diameters 24–28 inches with individuals of much larger size.

2. *The white birch type follows fire,* but later white spruce enters the stand to form a mixed type. Fires perpetuate the birch and reduce the spruce representation. At 100 years or so birch declines as decay increases and the stand moves gradually toward the climax. In the essentially pure stands, birch at maturity seldom exceeds 80 feet in height or 18–20 inches in diameter.

3. *Quaking aspen also follows fire* and in the absence of fire or cutting is gradually replaced by white spruce. Fire maintains aspen because that species reproduces from both root suckers and seed. After 50 or 60 years decay opens up the stand. Average maximum heights and diameters are 60 feet and 10 inches, respectively.

4. *White spruce-white birch and white spruce-aspen are transition types.* With absence of fire, spruce gradually invades the white birch type or the aspen type to form a mixture, with spruce dominant after the birch or aspen reach maturity. When mixtures are about even, mature heights are: spruce 65–75 feet; birch 60–70 feet. Average maximum diameters: spruce 13 inches; birch 15 inches.

5. *The tacamahac poplar type often maintains itself,* especially if the streams along which it occurs are subject to periodic overflow. Heights of 70 feet and diameters of 36 inches are common. White spruce sometimes enters the stand and gains dominance. Where this happens it will eventually replace the poplar. Fires are uncommon in poplar stands. The species has a thick bark which makes it more fire resistant than other Alaskan forest trees and reduces damage from most of the few fires which do occur. Following destructive fires it regenerates much as aspen does.

6. *The black spruce type also maintains itself,* as it commonly occurs where drainage is poor and the permafrost table is close to the surface. On such sites it seldom becomes of merchantable size. Competition from other species is light on the poorly drained habitat and black spruce is considered a physiographic climax on these sites. Stand densities are high; even at 100 years there may be 2,000–3,000 trees per acre 1 inch in diameter and larger. Average maximum heights in mature stands seldom exceed 45 feet and diameters

8–9 inches. Reproduction is by layering and seedling growth. Fires are intense; the density and small size of the trees favor crown fires.

Timber Volume Is Substantial and Net Growth Is Good in Spite of Fire

The commercial forests of the Interior are not stunted Arctic stands. They are in various stages of recovery following fires. Some are just reproducing, while others have been unburned for more than 100 years. Volumes of these older stands are comparable to those of southern Ontario or northern Maine. Occasional spruce stands of 15 thousand board-feet per acre are found. Trees 24 to 30 inches in diameter at not over 200 years have been found north of the Arctic Circle. Mortality due to fire, insects, disease, and climatic damage is an unknown factor. Rates of growth, yields at various ages, and location of the best stands all await study. Cutting is pretty much confined to the spruce type, although spruce-birch has almost equally high volumes. Pure birch, or birch with spruce in the understory, forms dense stands over large areas and probably runs as high as 8 thousand board-feet to the acre. Amount or kind of defect taking the largest toll is unknown. There is an immense resource in spite of great losses from fire and other destructive agents.

Thirty-Two Billion Cubic Feet Await Use

It is estimated that Interior stands average about 800 cubic feet or 4,500 board-feet per acre. Thus, the 40 million acres of commercial forest land support an estimated total volume of 32 billion cubic feet and 180 billion board-feet. Approximately 72 percent of the volume is estimated to be softwoods (mostly spruce) and 28 percent hardwoods (mostly birch).

	Area (thousand acres)	*Sawtimber (thousand bd.-ft.)*	*Growing stock (thousand cu. ft.)*
Softwoods	28, 932	130, 194, 000	23, 145, 600
Hardwoods	11, 068	49, 806, 000	8, 854, 400
Total	40, 000	180, 000, 000	32, 000, 000

Net Growth Could Be Much Greater

Growth could be greatly increased through more adequate fire protection. Fires destroy not only stands of commercial size, but immature stands which may take as much as 10 years to reproduce. Thus growth is being retarded over large areas through failure of stands to reach maturity or areas to restock, and stands generally are kept more or less continuously in a poor growing condition.

It has been estimated that mature 160-year-old stands on good sites will contain about 3,900 cubic feet per acre of growing stock and 15,500 board-feet of sawtimber. The mean annual net increment indicated by such stands of 24 cubic feet and 97 board-feet per acre totals nearly 1 billion cubic feet of growth annually including 3.9 billion board-feet, as shown in the following tabulation:

		Total net growth	
	Area (thousand acres)	*Sawtimber (thousand bd.-ft.)*	*Growing stock (thousand cu. ft.)*
Softwoods	28, 932	2, 806, 404	694, 368
Hardwoods	11, 068	1, 073, 596	265, 362
Total	40, 000	3, 880, 000	959, 730

Mortality Losses Are High

Sawtimber mortality caused by a combination of fire, insects, disease, and climatic factors have been roughly estimated at 2 billion board-feet per year on commercial forest land. It is estimated that about 50 percent of total mortality is due to fire. What part is caused by insects and disease separately cannot be estimated on a practical basis. Since practically all of the Interior has been burned at least once, stands are young and subject to less damage by insects, disease, and windthrow than would be the case if the stands were more mature.

During the past 3 years, rough surveys of existing forest insects and diseases have been made annually. Before that, only occasional trips into the Interior were made by forest entomologists and pathologists. Of the insects, *Dendroctinus borealis* has been very destructive of white spruce, and during 1949 and 1950 much of the timber between Anchorage and Palmer, 40 miles north, was badly damaged. Many insects have been identified as common to the tree species of Interior Alaska and many diseases also have been found. Losses due to wind and animals also doubtless occur. However, no quantitative data exist upon which to base individual estimates of the mortality and growth losses due to these destructive agencies.

Protection Is Difficult in a Frontier Country

In the more inhabited areas, fire control is attempted. In remote areas little can be done as yet. Fire protection began in 1939 with the organization of the Alaskan Fire Control Service, under the General Land Office. Prior to that from 5 to 8 million acres were burned each year. With very limited funds this agency succeeded in reducing the annual burn from 4.5 million acres in 1940 to 117 thousand acres in 1945, but this was partly due to cessation of normal pursuits such as mining and trapping during the war years. With a resumption of these activities following 1945

there was a sharp increase in the area burned to 1.5 million acres in 1946 and 1947.

In 1947 the work of the General Land Office was assumed by the Bureau of Land Management. Subsequent efforts to reduce the annual burn were made in the face of an increase in population of 150 percent, an increase in road mileage of 71 percent from 1940 to 1952; and an increase in car licenses of 269 percent between 1947 and 1952.

Areas burned during the past 15 years are as follows:

Year:	Area burned (thousand acres)	Year:	Area burned (thousand acres)
1940	4, 500	1948	35
1941	3, 655	1949	18
1942	453	1950	2, 064
1943	667	1951	222
1944	111	1952	75
1945	117	1953	473
1946	1, 439	1954	1, 431
1947	1, 432		

Accent Must Be on Fire Protection

After 10 years of fire control effort the Territorial Fire Control Act of 1949 was passed. This establishes a fire season from April 30 to September 30, inclusive, and provides for additional periods when conditions warrant. The Governor, by proclamation, may prohibit setting of fires, smoking, entry, or other use in designated areas. The act also includes other provisions for prevention, suppression, and control and imposes civil and criminal liability for violations.

Acquisition of evidence against violators of fire laws is limited and difficult because of the immense area, much of it remote, limited personnel, and poor transportation. Effort is being made by the Bureau of Land Management to supplement public education on fire problems with timely prosecution proceedings.

Three-Fourths of the Fires Are Caused by Man

In spite of the low population, at least 75 percent of the fires are caused by man, many in remote parts of the Interior where control is next to impossible. Records collected during the years of protection effort show the causes of forest or range fires to be as follows:

	Percent		Percent
Campfires	27	Incendiary	3
Debris burners	24	Railroad	2
Lightning	17	Miscellaneous	11
Smokers	16		

Education Is Needed

In the face of public indifference the present fire control organization is inadequate to hold the annual burn to a reasonable level. Alaskans, as well as tourists, defense workers, and members of the Armed Forces serving in the Interior must be informed of the devastating effects of fire on the forest and range resource, as well as the damage to water, soil, and many forms of wildlife. The fire risk is annually becoming more acute because of the increasing population, greater tourist activity, and extended road system.

There is great need for fire research to develop a danger rating system applicable to the Interior. The combination of fuel types, low precipitation and humidity, and high winds and high temperatures coupled with long hours of summer sunshine probably create as severe fire danger as exists anywhere on the North American Continent.

The Forest Economy Is in a Pioneer Stage

Present conditions in the Interior are probably typical of the pioneer stage of development. As in the early days in the States, there are vast areas undeveloped, a great excess of growth over cut, high losses due to fire, insects, and disease, and a rapidly expanding population, which so far has been associated with defense activities. The construction of the Government railroad and automobile roads to connect with the Alcan Highway through Canada to the States has resulted in great belts of burned-over country. Still, there are large areas of timber of a size suitable for the manufacture of forest products.

Birch stands of good quality and volume equal to or greater than those in the northern Lake States or New England are available and many are accessible. The great areas of spruce, spruce-birch, aspen, and cottonwood could supply pulp mills, as in the Northeast.

Present requirements are difficult to determine as imports are unknown. For all of Alaska in 1947 there were 7 million dollars' worth of forest products imported. How much went to the Interior is unknown, and since 1947 there are no records of imports except from foreign countries. With a population, according to the 1950 census, of perhaps 80,000 people in the Interior of Alaska and an estimated civilian per capita use of 150 board-feet, the demand would be only 12 million board-feet.

It has been estimated, however, that the population of such centers as Anchorage and Fairbanks has increased so much that the Interior's present population (1954) may be nearer 130,000, which would call for 19.5 million board-feet for civilian use. Construction and maintenance by the Armed Forces in the Interior would probably increase this to 30 or 40 million board-feet.

Industries based on Alaska's Interior forest products are almost nonexistent; certainly not of a size for export. The forests make little or no

contribution to the Territorial industrial economy, being used only for rough lumber, house logs, and fuel. Some 66 small sawmills, mostly portable, produce from 8 million to occasionally 20 million feet of rough lumber in a year. The annual rated capacity of them all is about 45 million feet, but such mills seldom operate at capacity.

Even if existing mills improved their manufacturing processes and increased production to capacity, the entire needs of the Interior would probably not be met. Specialty products and special grades would continue to come from the outside.

General unfamiliarity with the timber resource of Interior Alaska and the lumber markets, as well as with the industry in general, has resulted in an unfavorable climate for industrial development. The lack of experienced loggers and mill operators in the Territory coupled with the customary operation of mills as a sideline rather than as a full-time business has failed to develop confidence. It has also failed to develop a product which inspires pride on the part of the operator and satisfaction on the part of the consumer.

The domestic problem is one of development of forest products industries to meet local needs, protection to reduce the risks to invested capital, adequate methods of financing, and "know-how."

Of greater importance for the future is the significance of this resource as a reserve available to meet increased requirements originating beyond the borders of the Territory. The great growth of world population, shared by the United States, indicates an increasing requirement for forest products, particularly of softwoods. The marked trend toward increasing pulp production, for which Alaskan species are well suited, and the need for additional supplies is rapidly expanding the boundaries of economic accessibility. Forest industries are already moving northward in Canada, especially in British Columbia and along the Pacific Coast to Southeastern Alaska. Mineral and power developments also share this trend. The need for forest products from Alaska's Interior lies in the future, but current trends toward greater demand indicate that the present losses suffered by this resource should be substantially reduced.

CANADA'S TIMBER SITUATION

Canada's forest resources are of great importance to the United States. Most of Canada's forests are of species and timber size-classes that are peculiarly adapted to pulp and paper making. From these forests the United States imports three-fourths of the newsprint paper it uses, considerable quantities of woodpulp and pulpwood, and some lumber. The forests of large-size, virgin timber in British Columbia also supply the United States with substantial quantities of high-quality softwood lumber.

Forests Cover More Than Two-Fifths of Canada

Canadian forests cover 951 million acres out of a total of 2.2 billion acres (exclusive of Labrador). The comparable figures for the Continental United States are 648 million acres of forest land and 1.9 billion acres of total land area. The Canadian forests grade from readily accessible commercial forests, in the belt adjacent to the southern border, to completely inaccessible, sparse, scattered, noncommercial forest in the cold, windswept, northern tundras (fig. 102). Excluding the Yukon and Northwest Territories, 60 percent of the land area is forested; more than 80 percent of the total forest area is in the ten Provinces (table 183).

Table 183.—*Land classification of Canada,*[1] *by region, 1953*

Region	Land area				Relation of forest to total land area
	Total	Forest		Nonforest	
	Million acres	*Million acres*	*Percent*	*Million acres*	*Percent*
Maritime Provinces [2]	56	38	4	18	68
Quebec	335	221	23	114	66
Ontario	223	143	15	80	64
Prairie Provinces [3]	441	214	22	227	48
British Columbia	230	159	17	71	69
Yukon and Northwest Territories	933	176	19	757	19
Total	2,218	951	100	1,267	43

[1] Exclusive of Labrador.
[2] Newfoundland, Prince Edward Island, Nova Scotia, and New Brunswick.
[3] Manitoba, Saskatchewan, and Alberta.

Source: Canada Department of Northern Affairs and National Resources (formerly Department of Resources and Development), Forestry Branch. Bulletin 106 Amended 1954.

LEGEND
FOREST FORMATION
BOREAL FOREST REGION
PREDOMINATELY FOREST
ASPEN-GROVE
FOREST AND BARREN
SUBALPINE FOREST REGION
MONTANE FOREST REGION
COAST FOREST REGION
COLUMBIA FOREST REGION
DECIDUOUS FOREST REGION
GREAT LAKES-ST LAWRENCE FOREST REGION
ACADIAN FOREST REGION
GRASSLAND FORMATION
TUNDRA FORMATION (ARCTIC AND ALPINE)
PRINCIPAL SPECIES
SPRUCE, BALSAM, WHITE BIRCH, JACKPINE, POPLAR (ASPEN)
ENGELMANN SPRUCE, LODGEPOLE PINE
PONDEROSA AND LODGEPOLE PINES, SPRUCE, DOUGLAS-FIR
DOUGLAS-FIR, CEDAR, HEMLOCK, SITKA SPRUCE
ENG SPRUCE, DOUGLAS-FIR, CEDAR, HEMLOCK, LARCH
TOLERANT HARDWOODS
PINE, SPRUCE, YELLOW BIRCH, MAPLE
SPRUCE, BALSAM, YELLOW BIRCH, MAPLE, PINE
ALASKA
PACIFIC OCEAN
YUKON TERRITORY
BR. COL.
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
NORTHWEST TERRITORIES
HUDSON BAY
UNITED STATES
GREENLAND
ATLANTIC OCEAN
LABRADOR
NEWFOUNDLAND
NEW BRUNSWICK
P.E.I.
NOVA SCOTIA

Figure 102

The area of commercial forest land is estimated at 529 million acres.[54] The heaviest concentration of commercial forest land occurs in the Maritime Provinces and in Quebec and Ontario; in each of these, commercial forest accounts for approximately three-fourths of the forest land area (table 184). Softwood species predominate on 63 percent of Canada's commercial forest area, hardwoods on 12 percent, and a mixture of the two on the remaining 25 percent.

The noncommercial forest is usually stunted, sparsely stocked, and chaarcterized by species that can endure swamp and tundra-fringe conditions. These noncommercial forest lands are principally valuable for food and shelter for wildlife.

Of the commercial forest area, 370 million acres are accessible, i. e., are economically operable under present conditions. The remainder will probably become accessible as transportation systems are extended, as prices rise, and as wood markets expand. The greatest concentration of accessible forest is in the Maritime Provinces, Quebec, Ontario, and British Columbia (fig. 103).

[54] Includes about 40 million acres in National and Provincial Parks.

Most Forests Are Publicly Owned

Approximately 93 percent of the total forest area of Canada is publicly owned, i. e., is in the possession of the Crown; the remaining 7 percent is privately owned (fig. 104). The corresponding percentages for commercial forest land are 88 and 12, respectively. This is in striking contrast to the United States, where 74 percent of the commercial forest area is privately owned. In Canada there has been little effort to move Crown land into private ownership. Rather, the policy has been to retain title to forest land in the Dominion Government. Administration of most of the public land in the provinces rests with the Provincial Governments.

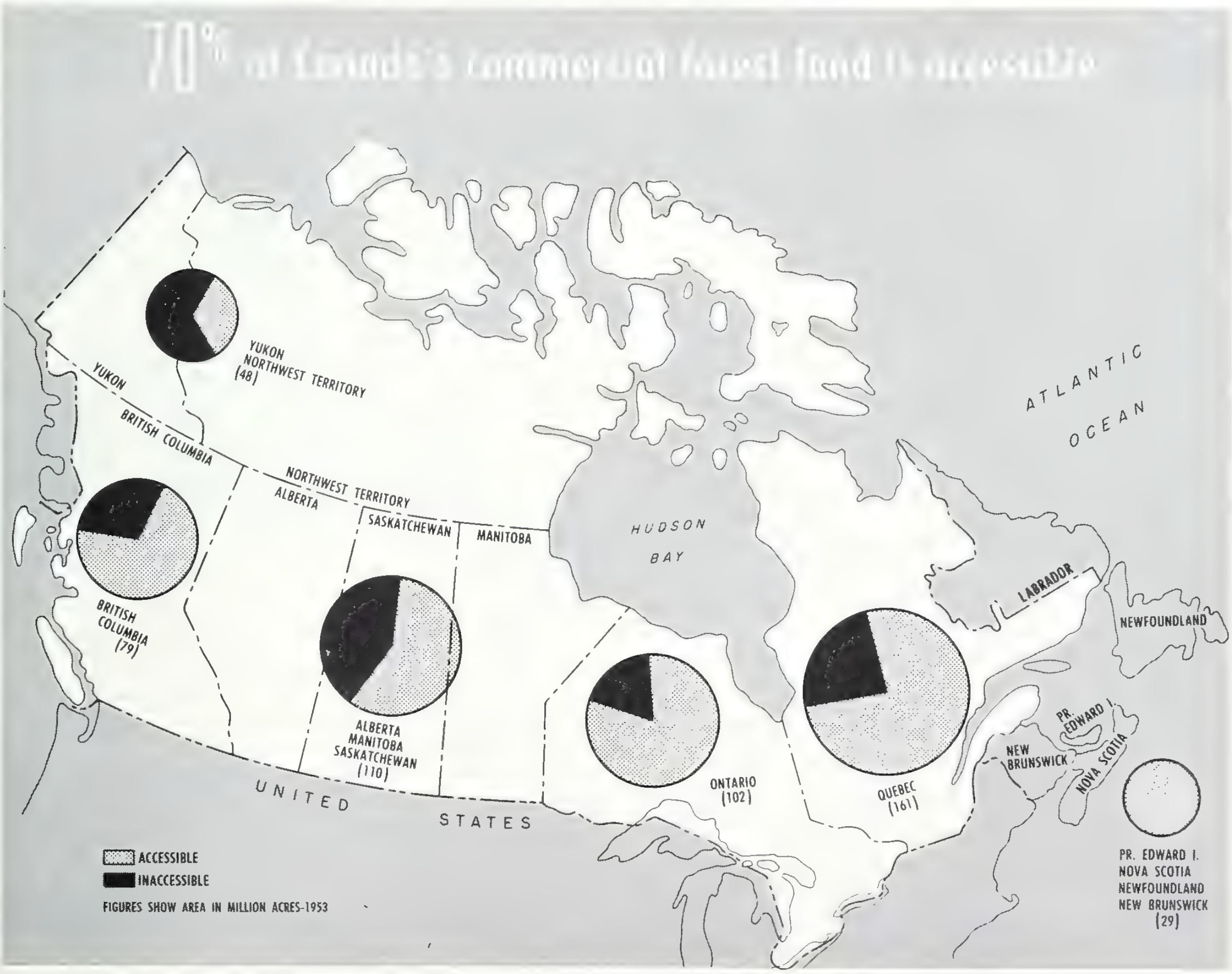


Figure 103

TABLE 184.—*Commercial and noncommercial forest land area in Canada,*[1] *by region, 1953*

Region	Total	Commercial [2]			Relation of commercial to total forest area	Noncommercial
		Total	In region	Accessible		
	Million acres	*Million acres*	*Percent*	*Million acres*	*Percent*	*Million acres*
Maritime Provinces [3]	38	29	6	29	76	9
Quebec	221	161	30	123	73	60
Ontario	143	102	19	83	71	41
Prairie Provinces [4]	214	110	21	64	51	104
British Columbia	159	79	15	55	50	80
Yukon and Northwest Territories	176	48	9	16	27	128
Total	951	529	100	370	56	422

[1] Exclusive of Labrador.
[2] Forest lands physically capable of producing crops of usable wood that are economically exploitable now or prospectively.
[3] Newfoundland, Prince Edward Island, Nova Scotia, and New Brunswick.
[4] Manitoba, Saskatchewan, and Alberta.

Source: Canada Department of Northern Affairs and National Resources (formerly Department of Resources and Development), Forestry Branch. Bulletin 106. Amended 1954.

The National and Provincial Governments have reserved approximately 95 million acres for special purposes. Some 40 million acres have been set aside as national and provincial parks, primarily for recreational use. On these areas, timber is definitely not available for commercial cutting operations. Some 48 million acres are in provincial forest reserves, roughly comparable to national forests in the United States. On these, commercial cutting under certain regulations is permitted. An additional 7 million acres are in military, Indian, and other reserves.

Approximately 141 million acres of Crown forest lands, administered either by the Dominion or Provincial Governments, are occupied, i. e., have been leased or licensed or otherwise contracted for by private timber operators.[55] Of this total, 117 million acres are held as pulpwood licenses. In Quebec, Ontario, Newfoundland, and Nova Scotia, pulpwood licenses account for about 90 percent of leased and licensed land. Elsewhere, the sawtimber licenses become more important and, for the nation, account for 21 million acres. The remaining 3 million acres are covered by sales of timber and other types of permits.

Some 62 million acres are privately owned timberland, of which 39 million acres are held by nonfarm owners and 23 million acres are in farm woodlots. These woodlots, ranging in area from 3 to 200 acres or even more, contain some of the most accessible timber in Canada. Some 60 percent of the farm woodlot area is in eastern Canada, where because of more favorable climatic and soil conditions it is generally rather productive.

[55] It is likely that scattered parts of the areas covered by leases and licenses may actually be noncommercial. No data regarding the size of this noncommercial area are available. Estimates as high as 25 percent have been made.

Subtracting the area of occupied Crown forest, national and provincial parks and reserves, and private forest land from the commercial forest area leaves 231 million acres of commercial Crown forest land that is unoccupied and awaiting license or lease. Some of this, of course, is not readily accessible.

Although it is conceivable that some of the 422 million acres of noncommercial forest land may, with the opening up of transportation systems, become commercial, most of it will probably remain noncommercial.

TIMBER VOLUME IS CHIEFLY SOFTWOOD

The timber volume on the commercial forest area is estimated to be 397 billion cubic feet [56] including 782 billion board-feet [57] or an average of 750 cubic feet and 1,478 board-feet per acre (tables 185, 186, and 187, and fig. 105). This contrasts with an average of approximately 1,000 cubic feet and 4,100 board-feet per acre for the United States. Of the total cubic volume, 61 percent is spruce, balsam fir, and hemlock, which are prime pulping species. An additional 22 percent is pine, cedar, Douglas-fir, and other softwoods. Only 17 percent is hardwood, chiefly poplar (aspen) and white birch.

It is estimated that 70 percent of the cubic-foot volume and 75 percent of the board-foot volume is found on areas now considered to be accessible.

[56] In trees 4 inches and larger in diameter at breast height.
[57] In trees 10 inches and larger in diameter at breast height. It is possible that the timber-volume estimate may be conservative. Modern sampling surveys have covered only about one-fourth to one-third of the commercial forest area, and as surveys progress the reported timber volume has steadily increased.

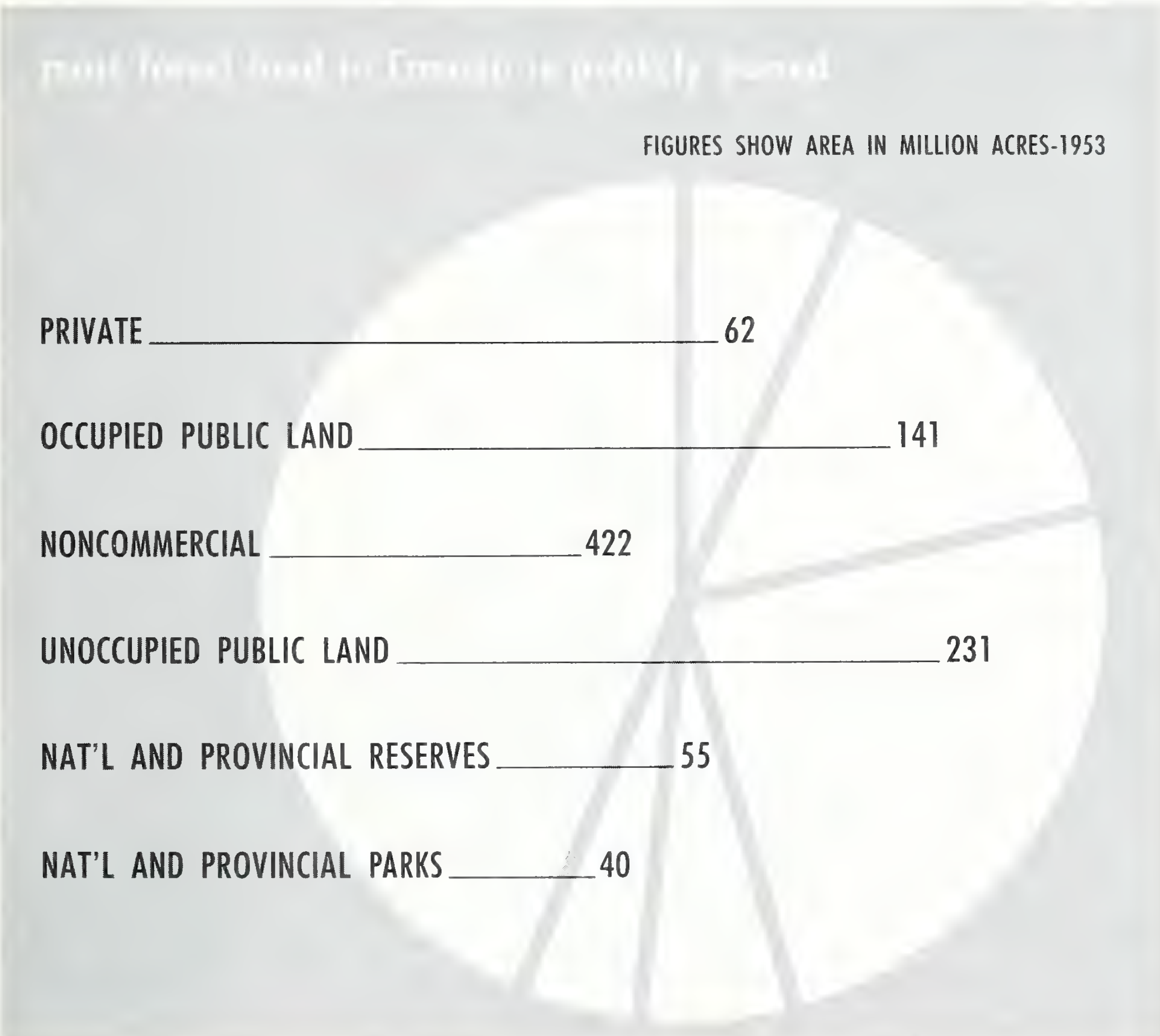


Figure 104

Of the accessible board-foot volume, 70 percent is found in British Columbia (table 188). In this Province is concentrated the large-size Douglas-fir, hemlock, and cedar timber. Current high-quality lumber imports into the United States are largely dependent upon this resource. Viewed from another angle, this concentration of saw-timber in British Columbia indicates that elsewhere trees of smaller size predominate. Canada's forest resource, therefore, both as to species composition and size class of timber, is admirably suited to support an extensive and highly developed pulp and paper industry.

Information on Timber Growth and Mortality Is Generally Lacking

Such information on annual timber growth as is available pertains to timber on 190 million acres of commercial forest land under exploitation. For this portion of the resource, net annual growth in 1952 was estimated to be 2.4 billion cubic feet. If the stands were comparable over the entire 529 million acres of commercial forest land, net annual growth would be about 6.6 billion cubic feet. However, much of the area not under ex-

ploitation is occupied by old-growth timber having little if any net growth. Thus, growth per acre on these areas might average only about half as much as on areas now being exploited. Assuming this to be a reasonable conjecture, it is possible to derive a very rough total estimate of 4.5 billion cubic feet of net annual growth for all stands combined and an average net growth per acre of 8.5 cubic feet. Rough as these estimates are, they apparently are not unrealistic considering

TABLE 185.—*Volume of merchantable timber*[1] *on commercial forest land in Canada, by species and accessibility class, 1953*

Species	Total		Accessible forest land		Inaccessible forest land	
	Million cu. ft.	*Percent*	*Million cu. ft.*	*Percent*	*Million cu. ft.*	*Percent*
Softwood:						
Spruce	150, 231	38	99, 861	36	50, 370	41
Jack and lodgepole pine	45, 583	11	29, 292	11	16, 291	13
Balsam fir	62, 106	16	40, 510	15	21, 596	18
Hemlock	27, 811	7	19, 520	7	8, 291	7
Cedar	20, 094	5	14, 584	5	5, 510	4
Douglas-fir	15, 198	4	10, 364	4	4, 834	4
Other softwood	6, 803	2	5, 824	2	979	1
Total	327, 826	83	219, 955	80	107, 871	88
Hardwood:						
Poplar (aspen)	37, 482	9	27, 276	10	10, 206	9
White birch	21, 663	5	17, 892	7	3, 771	3
Yellow birch	3, 856	1	3, 856	1	----------	--------
Maple	3, 290	1	3, 290	1	----------	--------
Other hardwood	3, 196	1	2, 999	1	197	--------
Total	69, 487	17	55, 313	20	14, 174	12
All species	397, 313	100	275, 268	100	122, 045	100

[1] All trees 4 inches d. b. h. and over.

Source: Canada Department of Northern Affairs and National Resources (formerly Department of Resources and Development), Forestry Branch. Bulletin 106. Amended 1954.

TABLE 186.—*Volume of sawtimber*[1] *on commercial forest land in Canada, by species and accessibility class, 1953*

Species	Total		Accessible forest land		Inaccessible forest land	
	Million bd.-ft.	*Percent*	*Million bd.-ft.*	*Percent*	*Million bd.-ft.*	*Percent*
Softwood:						
Spruce	231, 010	29	173, 285	30	57, 725	29
Jack and lodgepole pine	59, 253	8	45, 613	8	13, 640	7
Balsam fir	117, 431	15	85, 316	15	32, 115	16
Hemlock	133, 038	17	94, 218	16	38, 820	20
Cedar	92, 032	12	65, 557	11	26, 475	13
Douglas-fir	70, 978	9	49, 608	8	21, 370	11
Other softwood	20, 143	3	17, 268	3	2, 875	1
Total	723, 885	93	530, 865	91	193, 020	97
Hardwood:						
Poplar (aspen)	33, 000	4	28, 265	5	4, 735	2
White birch	9, 938		9, 353		585	
Yellow birch	5, 710	3	5, 710	4	----------	1
Maple	4, 284		4, 284		----------	
Other hardwood	5, 180		4, 195		985	
Total	58, 112	7	51, 807	9	6, 305	3
All species	781, 997	100	582, 672	100	199, 325	100

[1] All trees 10 inches d. b. h. and over.

Source: Canada Department of Northern Affairs and National Resources (formerly Department of Resources and Development), Forestry Branch. Bulletin 106. Amended 1954.

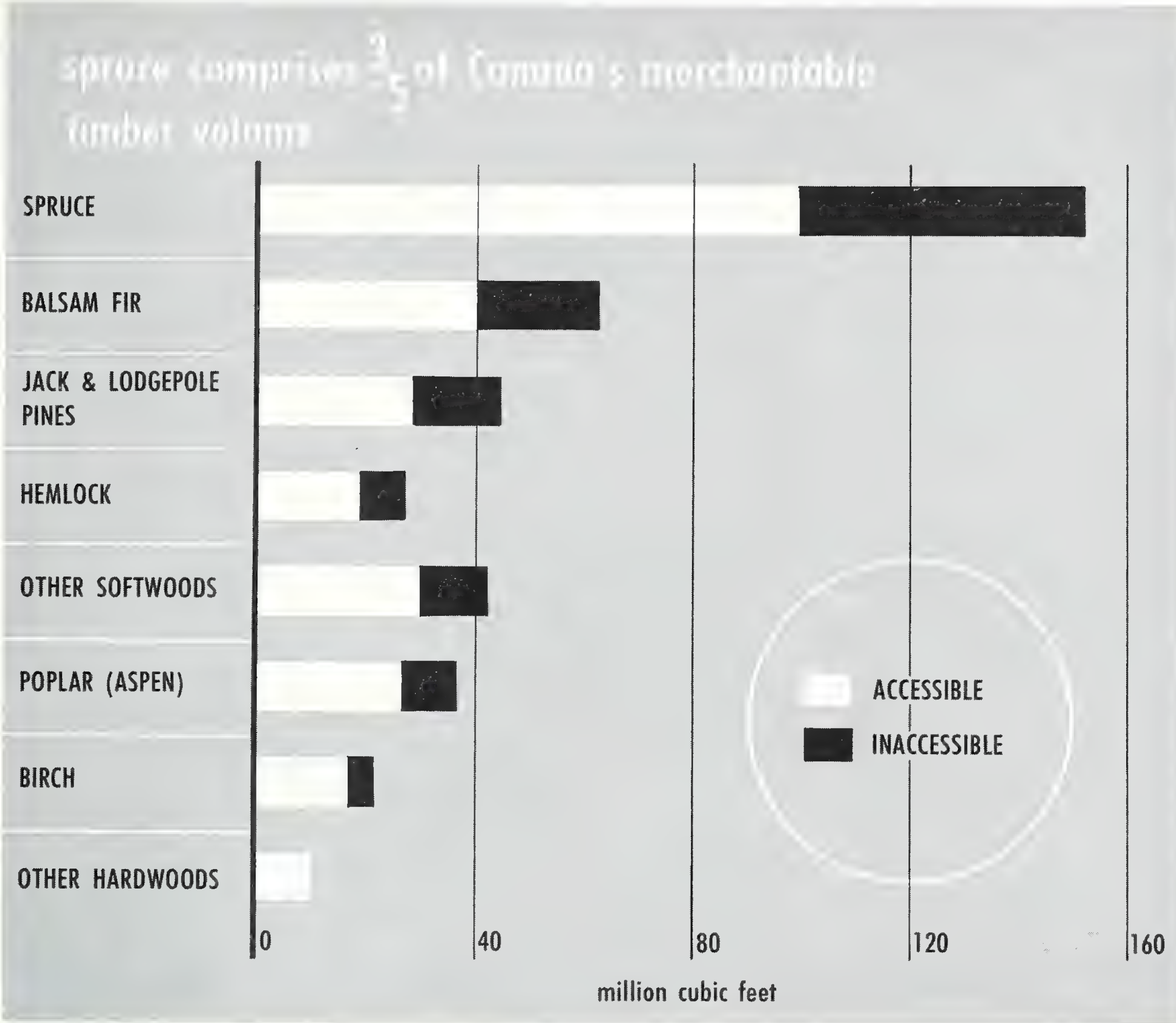


Figure 105

TABLE 187.—*Volume of merchantable timber* [1] *on accessible forest land in Canada, by region, 1953*

Region	Total		Softwood		Hardwood	
	Million cu. ft.	*Percent*	*Million cu. ft.*	*Percent*	*Million cu. ft.*	*Percent*
Maritime Provinces [2]	16, 019	6	12, 437	6	3, 582	7
Quebec	63, 701	23	45, 928	21	17, 773	32
Ontario	74, 151	27	54, 589	25	19, 562	35
Prairie Provinces [3]	24, 882	9	13, 875	6	11, 007	20
British Columbia	89, 322	32	88, 247	40	1, 075	2
Yukon and Northwest Territories	7, 193	3	4, 879	2	2, 314	4
Total	275, 268	100	219, 955	100	55, 313	100

[1] All trees 4 inches d. b. h. and over.
[2] Newfoundland, Prince Edward Island, Nova Scotia, and New Brunswick.
[3] Manitoba, Saskatchewan, and Alberta.

Source: Canada Department of Northern Affairs and National Resources (formerly Department of Resources and Development), Forestry Branch. Bulletin 106. Amended 1954.

TABLE 188.—*Volume of sawtimber*[1] *on accessible forest land in Canada, by region, 1953*

Region	Total		Softwood		Hardwood	
	Million bd.-ft.	*Percent*	*Million bd.-ft.*	*Percent*	*Million bd.-ft.*	*Percent*
Maritime Provinces[2]	15, 822	3	13, 041	2	2, 781	5
Quebec	52, 200	9	38, 181	7	14, 019	27
Ontario	76, 487	13	62, 378	12	14, 109	27
Prairie Provinces[3]	28, 327	5	13, 536	3	14, 791	29
British Columbia	407, 029	70	401, 652	76	5, 377	11
Yukon and Northwestern Territories	2, 807		2, 077		730	1
Total	582, 672	100	530, 865	100	51, 807	100

[1] All trees 10 inches d. b. h. and over.
[2] Newfoundland, Prince Edward Island, Nova Scotia, and New Brunswick.
[3] Manitoba, Saskatchewan, and Alberta.

Source: Canada Department of Northern Affairs and National Resources (formerly Department of Resources and Development), Forestry Branch. Bulletin 106. Amended 1954.

that the corresponding net growth per acre for more or less comparable stands in the State of Maine averages 8.5 cubic feet and in Coastal Alaska 7.5 cubic feet.

Annual timber mortality for 1952 was roughly estimated at 700 million cubic feet. This is indicated as being the total mortality due to combined effects of fire, insects, and disease with perhaps as much as 500 million cubic feet or about 70 percent of the total attributable to the latter two causes. There is no information which would indicate whether or not mortality from weather or animals and other natural causes is included in the total. Likewise, it is not clear whether the total estimated mortality represents a loss on only that part of the commercial forest area that is considered accessible, or on the total commercial forest area. If the former, the mortality is 0.25 percent of the volume on the accessible forest area. If the latter, the mortality is 0.18 percent of the volume on the total commercial forest area. The corresponding mortality for the United States is 0.7 percent of the growing stock volume on all commercial forest land.

Forest Industries Contribute Substantially to Canadian Economy

In 1951 the forest industries of Canada contributed 2 billion dollars (15 percent) to the net value[58] of the products of all Canadian industries. The contribution of the various segments of the forest-product industries to this total was as follows:

	Percent
Logging	31
Pulp and paper manufacturers	34
Lumber manufacturers	14
Wood-using industries	13
Paper-using industries	8
Total	100

The Provinces of Quebec, Ontario, and British Columbia led all others in forest industrial effort, accounting for 32, 28, and 25 percent, respectively, of the 2 billion dollars of net value of forest industries output.

The Canadian forest industrial plant consists of nearly 8,000 sawmills, 128 pulp and/or paper mills, 50 veneer and plywood mills, nearly 4,000 other wood-using industrial plants, and 421 paper-using establishments. More than 370,000 persons were employed (1951) on a man-year basis. More than a billion dollars were paid in salaries and wages. Between 1940 and 1951, the net value of products produced in these forest industry plants more than quadrupled. Part of this increase, of course, is due to the shrinking value of the dollar. Still further growth in the forest industries will undoubtedly be needed to keep pace with Canada's growing population and expanding industry and agriculture.

Canada's Timber Exports Are Mainly to the United States

Canada ranks third among the nations in volume of world trade; only the United States and the United Kingdom exceed it. With respect to forest products, Canada is the world's leading exporter, having in 1952 an aggregate forest-product export equivalent to 1,625 million cubic feet of round wood valued at 1.4 billion dollars. In that year,

[58] Net value is gross or sales value, less cost of materials, fuel, purchased electricity, and processed supplies consumed. It is the value added in the process of manufacture.

exports accounted for 45 percent of all wood utilized commercially. Approximately half of the lumber produced in Canada is currently exported and 75 percent of the paper and veneer; 10 to 12 percent of the plywood production is exported.

The United States receives approximately three-fourths of Canadian forest-products exports (table 189). It receives 99 percent of Canadian exports of veneer, 90 percent of paper, 85 percent of plywood, 82 percent of woodpulp, 80 percent of pulpwood, and 67 percent of lumber. In general, this is a mutually advantageous relationship. The United States gets wood products, and Canada gets foreign exchange with which to purchase industrial and other products. Canada would, however, prefer to export completely processed wood, such as finished paper and plywood. In the future, Canadian exports of unprocessed round wood—pulpwood, for example—may decrease in order that greater quantities of pulpwood can be processed in Canada and exported as paper or woodpulp.

Canada's imports of forest products account for only 3 percent of its total imports. Varieties of paper products not manufactured in Canada make up a large part of these imports. Partially manufactured wood products, rosin, turpentine, gums, resins, and cork are also imported.

TABLE 189.—*Production and export of principal forest products, Canada, 1952*

Item	Lumber	Pulpwood [1]	Woodpulp	Paper	Veneer [1 2]	Plywood
	Million bd.-ft.	*Million cu. ft.*[3]	*Thousand short tons*	*Thousand short tons*	*Million sq. ft.*	*Million sq. ft.*
Production	6, 808	1, 280	8, 968	7, 202	551	[4] 595
Total export	3, 340	244	1, 941	5, 526	408	72
Export to United States	2, 252	196	1, 589	4, 990	402	61
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Relation of total export to production	49	19	22	77	74	12
Relation of export to United States to total export	67	80	82	90	99	85

[1] 1951 figures.
[2] $\frac{1}{20}$-inch thickness basis. Does not include an unknown footage produced by the furniture and other veneer-using industries.
[3] Wood and bark.
[4] $\frac{1}{4}$-inch thickness basis.

TIMBER UTILIZATION COULD BE INCREASED

In 1952, Canadian forests supplied a cut of about 3.6 million cubic feet for domestic use and for export. They may ultimately be able to support a sustained cut of double this amount or 7.2 million cubic feet annually when they are under management and the old-growth forests have been converted to more productive stands.[59] This represents an increase in growth of from 50 to 60 percent above present levels.

Canada, like the United States, has experienced a rapid growth of its national economy in recent years. It might not be unrealistic to assume that the Canadian economy, due to expected increases in population and to current developments in the production of oil, electric power, and iron and uranium ores, may expand even faster than that of the United States during the next two decades. Under these conditions, it is logical to expect that Canada's timber supply will take on added importance, particularly from the standpoint of supplying its own domestic requirements.

If growth is increased substantially, Canada may ultimately be able to expand its timber exports consisting primarily of softwoods in the form of pulpwood, woodpulp, and paper, as well as to support increased requirements resulting from rapid expansion of its own domestic economy. In projecting United States domestic timber requirements, an allowance is made for a conservative increase in imports chiefly from Canada from the equivalent of 1.18 billion cubic feet of roundwood in 1952 to 1.66 and 1.79 billion cubic feet in 1975 and 2000. Whether Canada will be able to support any more than these amounts to the United States will depend on its domestic growth, export requirements to other countries, and the rate at which the stands are brought under management and growth is increased.

The outlook for increased imports from Canada of softwood lumber of quality grades is not as encouraging over the long run as for pulpwood derived products. At present rates of cutting, there appears to be a 25 to 50 years' supply of old-growth Douglas-fir, which is perhaps the most important source of high-quality lumber in Canada. For this reason, it is believed unlikely that

[59] Food and Agriculture Organization of the United Nations. *Report of the Preparatory Conference on World Pulp Problems, Montreal, Canada, 25 April–4 May, 1949.* Canad. Pulp and Paper Assoc., June 1949.

the United States can count on much more lumber from Canada 25 and 50 years hence than was imported in 1952.

MEXICO'S TIMBER SITUATION

Mexico's timber resources and timber trade are small in comparison with those of the United States and Canada. Nevertheless, the United States does obtain pine lumber and other forest products from Mexico. Consequently, the possibility of continuing these imports warrants consideration.

Forest Area Is Relatively Small

The forest area of Mexico is estimated to be 64 million acres, roughly 13 percent of the total land area. This contrasts strikingly with a corresponding 34 percent in the United States. The following breakdown of this forest area may be roughly indicative of the general forest situation:

	Area	
	Million acres	*Percent*
Commercial forests:		
Tropical	27	42
Temperate	22	35
Total	49	77
Noncommercial forests	15	23
All forests	64	100

Roughly 75 percent of the commercial forest area, both tropical and temperate, is considered to be accessible. The tropical commercial forests, all hardwood, consist of some 12 million acres in the Yucatan Peninsula and 15 million acres in the remainder of tropical Mexico (fig. 106). The temperate commercial forests are mixed hardwood and softwood, and include approximately 10 million acres of virgin and moderately exploited areas and 12 million acres of heavy cutovers. The relative abundance of softwood and hardwood species is uncertain, but probably softwoods predominate on one-third of the commercial forest area and hardwoods on two-thirds. The noncommercial forest land is brushland and grazing land with scattered trees.

The pine and pine-oak forests are the most important forest types in Mexico, both in area and economic value. They contain about 30 species of pine, most of which are of commercial significance, and more than a hundred species of oak. Among the pines, the following species are believed to be the most important: Mexican white pine (*Pinus ayacahuite*), Apache pine (*P. engelmannii*), Montezuma pine (*P. montezumae*), Aztec pine (*P. teocote*), *P. leiophylla*, and *P. oocarpa*.

Pine predominates in the mountains at elevations ranging between 5,000 and 13,000 feet. Ordinarily the pine is gradually replaced by the oak at altitudes below this range. Most of the commercial pine timber is either in the Sierra Madre Occidental range, which extends from the Arizona border southward through the western half of the country, or is in the south coastal Sierra Madre del Sur. In east central Mexico, the Sierra Madre Oriental contains some pine at the higher elevations, but rough topography and light stocking practically disqualify it as a commercial source of timber. Even in the other mountain areas, much of the timber on high and rough terrain is at present out of economic reach. The development of railroad and road transportation appears to be needed to open up these softwood stands. In some instances, at least, it is questionable if the timber values on present markets are worth the investment and operating risks that would be involved.

The Mexican rain forest, prominent in the Yucatan Peninsula and westward in the Isthmus of Tehuantepec, occurs in the low, humid, tropical areas of heavy rainfall. Although several hundred commercial tree species are found within this type, it is chiefly prized for the scattered occurrence of three particularly valuable species: mahogany (*Swietenia macrophylla*), chicle (*Achras zapota*), and ramon (*Brosimum alicastrum*). In many areas, the forest cover is broken or reduced to secondary scrub because of shifting cultivation or heavy exploitation.

For the Nation as a whole, the forest land is owned about as follows:

	Percent
Federal	5
Communal	20
Private	75

This ownership pattern generally approximates that of the continental United States, where 74 percent of the commercial forest area is privately owned. The communal forests are of special significance because they are concentrated in the heavily populated and agriculturally important central plateau region. In 1949, about 2 million acres of federally owned forests were in national parks and 1.6 million acres were in forest reserves.

Timber Volume Is Small

No reliable estimates of Mexico's total timber volume exist. Recent approximations of average timber volume per acre range from 700 cubic feet for all forests to 2,000 cubic feet for accessible commercial forests. Assuming an average of 1,200 cubic feet per acre of commercial forest, the commercial timber volume would total about 59 billion cubic feet. The total timber volume on commercial forest land in the United States is 498 billion cubic feet. There is no basis for breaking down this 59 billion cubic feet by species, geographic area, or quality.

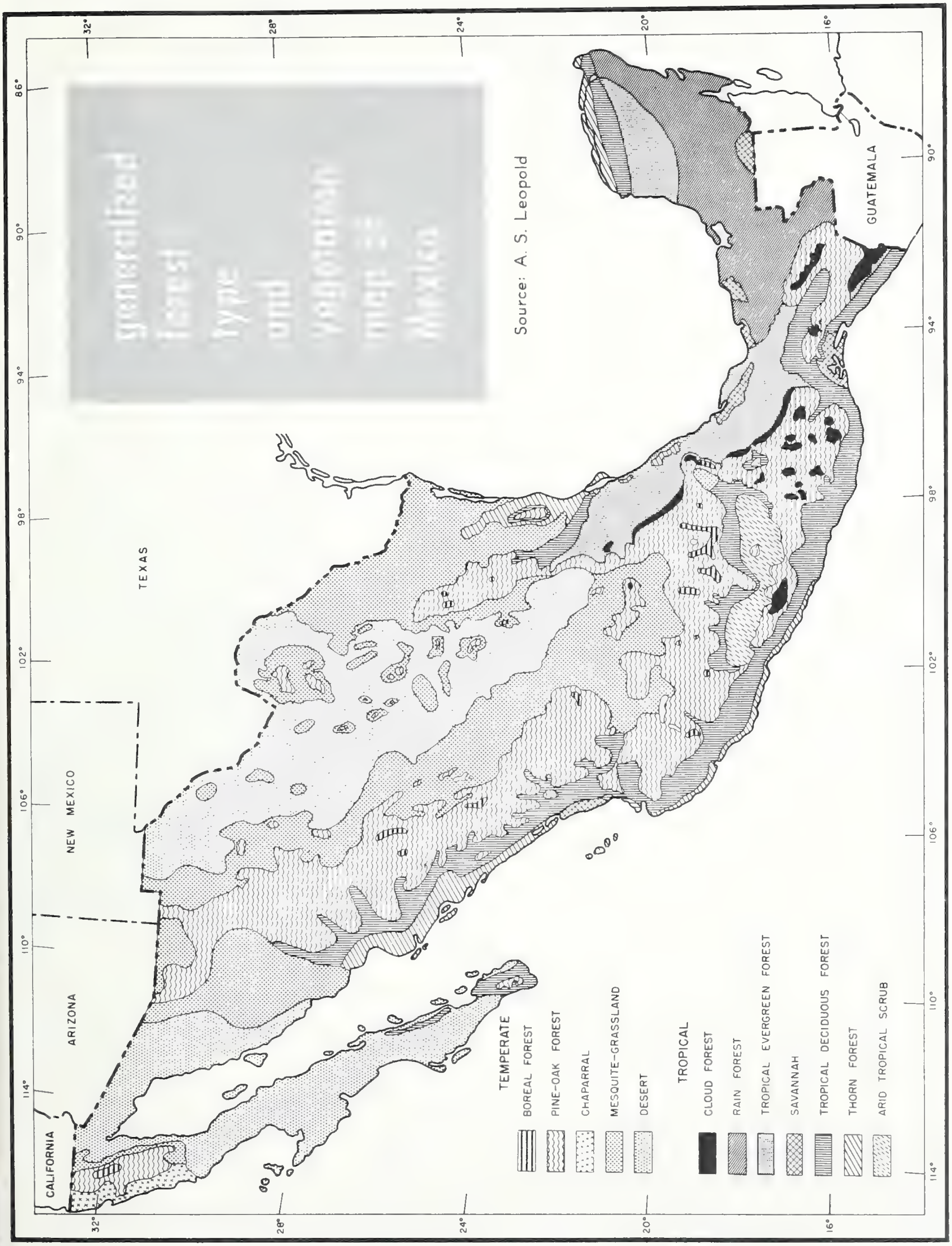

Source: A. S. Leopold
CALIFORNIA
ARIZONA
NEW MEXICO
TEXAS
GUATEMALA
TEMPERATE
BOREAL FOREST
PINE-OAK FOREST
CHAPARRAL
MESQUITE-GRASSLAND
DESERT
TROPICAL
CLOUD FOREST
RAIN FOREST
TROPICAL EVERGREEN FOREST
SAVANNAH
TROPICAL DECIDUOUS FOREST
THORN FOREST
ARID TROPICAL SCRUB
32°
28°
24°
20°
16°
86°
90°
94°
98°
102°
106°
110°
114°

Figure 106

Forest Industries Are Developing

Reliable statistics on the Mexican forest industries are also lacking, but these industries occupy only a minor position in the national economy. In 1953 forestry and the forest-products industries accounted for about 2 percent of the gross national product.

In general, forest operations are conducted on a modest scale. Tree felling is usually done with ax and handsaw; skidding is ordinarily done with horses, mules, or oxen. Only on the Yucatan Peninsula are tractors regularly used for skidding. Ordinarily logs are transported from forest to mill by truck.

Sawmills Are Locally Important

It is estimated that 170 sawmills operate in Mexico, producing in 1951 some 530 million board-feet of lumber. In addition possibly 100 million board-feet or more was handsawn in that year, chiefly for railway crossties. Three Mexican mills use bandsaws; all others use circular saws. The band mills and a few of the larger circular mills are reasonably modern and efficient and can produce lumber meeting export specifications. Most of the other mills are not so well equipped, and are unable to produce well-sawn lumber. The largest band mill has a daily capacity of more than 100,000 board-feet, and the circular mills produce an average of about 10,000 board-feet daily. A few mills have dry kilns, and most of the lumber is air dried briefly before it is marketed. Ordinarily lumber is graded only when it is exported. Currently pine lumber export accounts for 58 percent of the value of all forest products exported (including nonwood forest products).

It is reported that five or six United States-owned but Mexican-staffed sawmills are now operating in the States of Chihuahua and Sonora and are exporting the sawn lumber under license through Laredo, Tex., and other border towns. Little is known regarding the size and ownership of these mills, but their concession areas are known to be on private land. It is doubtful if, under present regulations governing the operation of foreign-owned enterprises in Mexico, new United States timber concessions will be opened. The Mexican Government appears to favor the establishment of domestically controlled processing plants and the export of such finished forest products as furniture, for example.

Pulp and Paper Mills Partially Meet National Needs

Of the 25 mills involved in the production of pulp and paper, 15 produce paper only, 6 produce paper and mechanical pulp, 3 produce paper and chemical pulp and 1 produces paper and both types of pulp. Annual capacity of the industry is reported to total about 240,000 short tons of paper. In 1953, production was estimated to be 132,000 tons of paper; consumption was roughly estimated at 265,000 tons. The import of 73,000 tons of newsprint in 1953 approximately accounts for the total consumption of that item. Of this 74 percent came from Canada, 12 percent from the United States, 12 percent from Finland and 2 percent from other European countries. Some pulp was also imported, especially bleached and dissolving pulps. The chief reason why pulp and paper production is so far below capacity is that the industry is concentrated in and near Mexico City, where raw material supplies are now very scarce. It is anticipated that by 1965 the demand for paper and board may be 600,000 tons.

Plywood Production Is Increasing

Seven major plywood plants now operate in Mexico and in 1950 produced some 65 million square feet of plywood, ¼-inch basis. Three of these plants are in the pine region, three in the tropical region, and one in Mexico City. A number of smaller mills produce small quantities of plywood, and also veneer for baskets, boxes, and crates. Construction plywood accounts for the bulk of the Mexican production, but the production of decorative plywood for furniture and paneling is increasing. Pine and oak are commonly used for construction plywood, and mahogany, Spanish cedar, and prima vera for decorative plywood. Plywood exports, chiefly of Spanish cedar, were more than 8 million square feet in 1950. The United States is the principal buyer.

Wood Is Widely Used for Fuel

Wood fuel, largely in the form of charcoal rather than wood, is the basic household fuel in Mexico. The volume of wood cut annually to meet this need is not known but may be conservatively estimated at about 260 million cubic feet. This is believed to be about 40 percent of the total utilized cut of timber. Charcoal is made by primitive and wasteful methods in crude, earth-covered mounds. Much of the timber converted to charcoal would be far more valuable if otherwise utilized.

Nonwood Forest Products Are Also Important

In the production of naval stores, Mexico ranks sixth among the producing countries in the world. During the period 1947–51 Mexico's output was about 3 percent of the world's production of turpentine and rosin. Except for one modern plant at Guadalajara, naval stores are produced in small, scattered plants. Tapping methods are generally severe, and much pine timber is lost because of heavy working for naval stores coupled with fire and insect damage. No wood naval stores are produced. During the period 1947–51 Mexico produced on the average 1.5 million gallons of turpentine and 24,314 short tons of rosin. About two-thirds of the turpentine and one-half of the rosin produced is exported. The rosin is chiefly exported to European and other Latin American countries, and the turpentine to the United States.

Chicle, the natural base for chewing gum, is produced from the exudation of the sapodilla tree which occurs in the tropical forests of southeastern Mexico and adjacent areas in Central America. The number of productive trees is rapidly shrinking because of excessive and indiscriminate tapping. The increasing availability of synthetic substitutes for natural chicle suggests that this industry will steadily decline in economic importance.

A few miscellaneous forest-product industries are known to be more or less active, but data on their output are lacking. These include a modern wallboard plant, a few small barrel and cask factories, furniture plants, and tannin extraction plants.

Timber Cut Is Thought To Exceed Growth

It is estimated that the average gross growth of Mexican forests is in the neighborhood of 14 cubic feet per acre per year. The total gross timber growth on commercial forest land may therefore approximate 700 million cubic feet. Noncommercial forest land supports almost no merchantable timber and makes no significant contribution to the usable timber growth.

Volume losses from fire, insects, disease, shifting agriculture, and other causes are unknown but are thought to be large. Partial reports indicate that during the period 1944–53 fire destroyed timber on about 105,000 acres annually. During 1948–52, bark beetle epidemics were reported to have covered about 35,000 acres annually. Assuming an average stocking of 1,200 cubic feet per acre and a 25 percent salvage rate, these partial estimates account for a loss of 125 million cubic feet. A more complete accounting of such losses might reach 200 million cubic feet. This would give a net annual growth of 500 million cubic feet or less than 1 percent of the timber volume on commercial forest land.

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A 1952 estimate of 700 million cubic feet for the annual timber cut is considered to be realistic. If the above assumptions are accepted, an annual timber deficit of some 200 million cubic feet would be indicated. However, estimates of commercial forest area, timber volume, and growth rates vary so widely as to shake confidence in the foregoing calculation, even though it appears to rest on a reasonable base. Of course, a considerable forest area supports virgin timber, on which growth about offsets mortality. When this virgin timber is replaced by a young growing forest, the total growth will be increased. Whether this increase will place Mexican timber production on a sound footing cannot be forecast at this time.

Foreign Trade in Forest Products Is Chiefly With United States

Trade with the United States accounts for 80–90 percent of Mexico's total foreign trade. The United States is the source of 95 percent or more of Mexico's imports of forest products, and is also the destination of most of Mexico's exports of such products. In terms of the total value of 1953 trade with the United States, forest products probably accounted for some 4.5 percent of Mexican exports and 3 percent of imports.

In 1952 Mexico's excess of wood exports (excluding pulp and paper products) over wood imports in trade with the United States was equivalent to 9.5 million cubic feet of roundwood. Lumber accounted for about 97 percent of the volume of wood products exported to the United States and 83 percent of the wood volume imported from the United States. In terms of roundwood equivalents, Mexico's 1952 wood exports were about 2.1 percent of estimated wood production. Postwar export restrictions and government production controls and other factors have caused a steady decline in the equivalent total volume of wood shipped from Mexico to the United States as is shown in the following tabulation:

Year:	*Million cu. ft.*
1950	30
1951	20
1952	15
1953	12
1954	11

When the value of woodpulp and its derivatives and nonwood forest products are considered along with the value of wood products, Mexico is a net importer of forest products from the United States. The value of all of these forest-product imports in 1953 was \$20.5 million and of the corresponding exports \$15.5 million.

Forest-Product Exports Likely To Decline

Evidence—apparently trustworthy—indicates that Mexico's forest resources are shrinking. Regardless of this, there are strong indications that, for the immediate future, at least, Mexican exports of wood and wood products will gradually decrease as the nation seeks self-sufficiency in these items. It would therefore appear that the United States cannot count on increases in imports of these items from Mexico.

THE WORLD TIMBER SITUATION

To complete the setting in which the timber situation of the United States should be appraised, a very brief look at the world's forest resources and timber trade is in order. However, the political situation which divides the world has largely cut off timber trade between the Free World and the Soviet Bloc of nations. Consequently the following discussion deals primarily with the forest resources of the Free World, although some reference to total world timber resources, and comparisons between Free World and Soviet Bloc resources are also given.

The discussion is largely based on the results of the 1953 world forest inventory conducted by the Food and Agriculture Organization of the United Nations.[60] The statistics were obtained from a questionnaire sent to member nations by F. A. O. of which 126—accounting for 73 percent of the world's forest area—replied. The essential information for the other countries was obtained from published official statistics, from questionnaires submitted in connection with a similar F. A. O. survey in 1947, from unofficial reports, and from estimates by F. A. O. personnel.

Only One-Fourth of Free World's Forests Under Exploitation

The total forest area of the Free World is estimated to be 7.4 billion acres (table 190). Softwoods predominate on 1.5 billion acres, hardwoods on 5.9 billion. Seventy-six percent of the Free World's softwood forest is in North America. Much of the rest is in free Europe. About 84 percent of the hardwood forests are in Latin America, Africa, and free Asia. Of the total forest area, some 4.0 billion acres are considered to be inaccessible. These latter forests are naturally found in remote areas, such as the colder zones of Alaska and Canada and the difficult parts of Latin America, Africa, and Asia. The improvement in communications that normally accom-

[60] *World Forest Resources*, Food and Agriculture Organization of the United Nations, Rome, Italy, pp. 1–120, illus. 1955.

Table 190.—*Approximate distribution of the Free World's forests, 1953*

Region	Total land area	Forested area			Accessible forests [1]	Forests under exploitation [2]		
		Total	Softwoods	Hardwoods		Total	Softwoods	Hardwoods
	Million acres	*Million acres*	*Million acres*	*Million acres*	*Million acres*	*Million acres*	*Million acres*	*Million acres*
North America [3]	4, 975	1, 799	1, 165	634	917	710	402	308
Latin America [4]	5, 046	2, 135	58	2, 077	775	194	24	170
Free Europe [5]	935	270	161	109	263	258	157	101
Free Asia [6]	2, 393	1, 054	114	940	661	485	32	453
Pacific Area [7]	2, 113	212	19	193	49	42	5	37
Africa	7, 339	1, 980	8	1, 972	702	267	5	262
Total, Free World	22, 801	7, 450	1, 525	5, 925	3, 367	1, 956	625	1, 331

[1] All forests now within reach of economic management or exploitation as sources of timber products, including immature forests and managed forests where fellings were prohibited.

[2] Forest yielding industrial wood and/or fuelwood.

[3] Includes United States, Alaska, Canada (excluding Labrador), and Mexico.

[4] Includes Central and South American countries listed in table 1, page 60, of report cited as source.

[5] Includes European countries listed in table 1, page 60, of cited report except for the following: European USSR, Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, and Rumania.

[6] Includes Asiatic countries listed in table 1, page 66, of cited report except for the following: Asiatic USSR, China, Manchuria, Tibet, North Korea, and Viet Minh.

[7] Includes Australia, British Solomon Islands, Fiji, Hawaii, New Guinea (Australia), New Zealand, Western Samoa, and others as shown in table 1, page 68, of cited report.

Source: *World Forest Resources*, Food and Agriculture Organization of the United Nations, Rome, Italy, pp. 1–120, illus., 1955. Data for North America revised to agree with statistics for individual countries given in other parts of this report.

panies general economic development together with improvements in logging and transportation equipment is steadily reducing the inaccessible forest area.

Of the 3.4 billion acres of accessible forest, 1.9 billion acres are in use, i. e., under exploitation. Thus approximately one-fourth of the total forest area is actually under exploitation. Virtually all of free Europe's forest areas are in use, but in Latin America less than one-tenth of the forest area is being exploited. By and large, the areas in use are the choicest and most economic ones with respect to traditional means of transportation and to present centers of population. The 1.4 billion acres of accessible forest not yet under exploitation will undoubtedly be put under use when economic conditions justify. Yields on some of these areas may be low and the species composition and timber quality may be relatively poor. Considering the Free World total, it would appear that the untapped forest resources are large.

Softwood Forests More Heavily Exploited Than Hardwood Forests

Of the 1.9 billion acres under exploitation, approximately 625 million acres are of softwood types and 1,331 million are hardwood. Thus 41 percent of the softwood forests are under exploitation, whereas only 22 percent of the hardwoods have yet been opened up for commercial operation.

Data are not available to warrant an estimate of the total timber volume of the Free World. It is, however, estimated that the 1.9 billion acres of forest now under exploitation support 2,431 billion cubic feet of growing stock (with bark), of which 35 percent is softwoods (table 191). About 70 percent of the softwood volume is found in North America while free Asia has 43 percent of the hardwood volume in forests under exploitation.

The volume of timber cut from the Free World's forests in 1953 is estimated at 36.8 billion cubic feet—17.0 billion cubic feet softwood and 19.8 billion cubic feet hardwood. This volume does not include unrecorded removals and illicit fellings in some countries which may account for substantial volumes in those parts of the world where accurate records are not maintained. North American countries account for about two-fifths of the total cut of all species in Free World's forests—nearly two-thirds of the total softwood volume and about one-fifth of the total hardwood volume (see regional fellings, p. 346).

Of the volume removed from the forests of the Free World, approximately 47 percent was used for fuel and 53 percent was used for industrial wood. The proportion of output that is industrial wood has been increasing during recent years.

On the basis of data from countries having about four-fifths of the world's exploited forest, net annual growth for the Free World's forest area under exploitation is estimated roughly at 18 billion cubic feet of softwood and 35 billion cubic feet of hardwood (without bark). All in all, it appears that in the exploited forests of the Free World as a whole, net growth of softwoods is slightly in excess of depletion of growing stock by cutting. However, for much of Europe, for the United States, and for other parts of the Free World, the requirements for softwoods are in excess of annual growth and throughout the world the softwood requirement is increasing.

Table 191.—*Growing stock in the Free World's forests under exploitation, 1953*

Region [1]	Growing stock (with bark) [2]						Estimated growing stock per acre	
	All species		Softwood		Hardwood		Softwood	Hardwood
	Billion cu. ft.	*Percent*	*Billion cu. ft.*	*Percent*	*Billion cu. ft.*	*Percent*	*Cubic feet*	*Cubic feet*
North America	836	34	601	70	235	15	1,495	765
Latin America	284	12	35	4	249	16	1,458	1,465
Free Europe	275	11	179	21	96	6	1,140	950
Free Asia	718	30	31	4	687	43	970	1,520
Pacific Area	35	1	7	1	28	2	1,072	786
Africa	283	12	4	(3)	279	18	575	1,072
Free World	2,431	100	857	100	1,574	100	1,366	1,187

[1] For included countries see references cited in footnotes to table 190.

[2] Growing stock volumes may not check with products of given acreages and volume per acre because of rounding.

[3] Less than 0.5 percent.

Source: *World Forest Resources*, Food and Agriculture Organization of the United Nations, Rome, Italy, pp. 1–120, illus., 1955, except for the United States for which growing stock includes volume on commercial forest land increased 10 percent for bark.

In the case of the exploited hardwood forests, best judgment indicates that removals from the forest may be only one-half to three-fourths of the growth. In the United States, and in other parts of the world as well, certain hardwoods can be and are being substituted for softwoods. As research discovers ways of using hardwood species for products traditionally made of softwoods, acceleration in hardwood use may reduce somewhat the pressure on the softwood resource.

Canada, United States, and Free Europe Dominate World Timber Trade

The equivalent of about one-ninth of the total Free World fellings of roundwood entered international trade in 1953 either in round or processed form. The extent of the foreign trade for major world regions is indicated by the following tabulation: [61]

	Regional fellings			Foreign trade	
Region	*Total*	*Soft-woods (billion cu. ft.)*	*Hard-woods (billion cu. ft.)*	*Imports (billion cu. ft.)*	*Exports (billion cu. ft.)*
North America	15. 0	11. 0	4. 0	1. 53	1. 73
Latin America	5. 6	. 4	5. 2	. 15	. 08
Free Europe	6. 7	4. 0	2. 7	1. 92	1. 97
Free Asia	4. 7	1. 3	3. 4	. 26	. 18
Pacific Area	. 8	. 2	. 6	. 06	. 01
Africa	4. 0	. 1	3. 9	. 13	. 08
Total	36. 8	17. 0	19. 8	4. 05	4. 05

The volumes entering international trade include trade between countries within each world region as well as trade between world regions. Viewing the situation by world regions, only free Europe and North America show a net export. The other regions of the Free World are net importers.

Pinpointing the situation, three countries—Canada, Finland, and Sweden—account for 69 percent of the Free World's wood-product exports (on roundwood equivalent basis); two countries—the United States and the United Kingdom—account for 57 percent of the Free World's wood-product imports.

Canada, Finland, and Sweden export chiefly paper, woodpulp, pulpwood, and softwood lumber. The United States imports chiefly newsprint paper, woodpulp, and softwood lumber, while for the United Kingdom the order of importance in imports is softwood lumber, woodpulp, pit props, and paper. From the character of the import and export items of those nations that dominate world trade in timber products, it is apparent that the backbone of such trade is in softwood products.

The pattern of world trade in various forest products varies greatly depending upon the bulk and relative value of the individual products. For example, there apparently is almost no limit on the distance that newsprint and other paper and some pulp items can be shipped. At the other extreme, fuelwood is seldom exported, or transported very far even within a country. International trade in forest products is therefore practically limited to industrial wood or the products processed from industrial wood.

The bulk of the trade in newsprint paper is from Canada to the United States. Most of the woodpulp trade is from Canada and Europe to the United States. The flow of softwood lumber is more diversified, although a large volume moves from Canada to the United States and to Europe. The flow of hardwood lumber is still more diversified, with free Europe, free Asia, Africa, and South America participating importantly.

Free Europe Likely To Need Its Own Output

Because free Europe accounts for 45–50 percent of the volume of world trade in forest products, because much of the European international trade is in softwoods, and because in the past Europe has exported a considerable volume of forest products to the United States, it will be helpful to consider more closely the free European softwood timber-supply situation.

Since 1935, free European sawn softwood consumption has shrunk by a fifth. Several factors have contributed to this. During the Nazi regime the cut of the German-controlled forests exceeded the allowable cut of their management plans in order to support the German military operations. This overcut continued during the first years of occupation. Accordingly, the restoration of German forests to former productivity requires a reduction in annual cut for an extended period. A parallel situation prevails in certain other countries. It is expected that within one to three decades European forests will again be able to support heavier cutting. A sharp curtailing of the output of timber products in some exporting countries has reduced the volume of exports available to other countries, even though the proportion of the output going into export may have been approximately maintained.

[61] Source: *World Forest Resources*, Food and Agriculture Organization of the United Nations, Rome, Italy, pp. 1–120, illus., 1955. Data for North America revised to agree with statistics for individual countries given in other parts of this report.

World War II seriously disrupted European imports of softwood forest products. The considerable volume normally imported into free Europe from the countries now under Communist influence has been greatly reduced, although strenuous efforts are being made in some quarters to renew this trade. In the case of the United Kingdom, dollar shortages have discouraged imports from Canada. The net results of this reduced supply of softwood timber in free Europe has been a sharp increase in the price of softwood forest products and a reduction in consumption.

Looking ahead to 1960 it is estimated that, even assuming a conservative rate of economic growth and 1950 prices, the requirement for all industrial wood in Europe (excluding USSR but including satellite countries) is expected to reach 6.9 billion cubic feet. The corresponding figure for 1950 was 5.9 billion cubic feet. Under present policies and programs, European production of industrial wood by that time will not exceed 5.5 billion cubic feet. From this it would appear that, for several decades at least, almost the entire softwood surplus of exporting countries, such as Sweden, Finland, and Norway, could be utilized within Europe.

United States Can Continue To Import but Expansion of Exports Limited by Domestic Needs

The United States has long been a net importer in respect to pulpwood, woodpulp, and paper. Up to about 1940, however, it has maintained a net export balance in both hardwood and softwood lumber (table 192). Now, with lumber exports sharply reduced, and with imports higher than in any earlier period, this country is also a net importer of lumber. Imports of softwood lumber and newsprint paper have increased particularly sharply since World War II. Since 1950 imports of softwood lumber have averaged about 2.6 billion board-feet or 8 percent of domestic softwood consumption. In the same period, imports of newsprint paper reached about 5 million tons a year—83 percent of consumption. Our imports of both of these items come chiefly from Canada, as does our 2-million-ton import of woodpulp, and our 1.5- to 2.0-million-cord import of pulpwood. Hardwood lumber—of which imports between 1950 and 1954 averaged 236 million board-feet and exports 130 million—comprises a much smaller volume of trade than softwood lumber and pulp and paper products.

Looking to the future, interest centers on softwood trade. Although important segments of the Free World face a shortage in softwood timber, the United States is in a favorable position with respect to supplies from undeveloped regions. Proximity and established trade relations might enable the United States to obtain substantial additional amounts annually from Canada and there are untapped resources in Interior Alaska. Supplementary supplies from these sources may help in meeting expanding needs of the American economy in the years ahead.

TABLE 192.—*United States: Imports and exports of principal forest products, by specified years*

Year	Softwood lumber	Hardwood lumber	All woodpulp	Newsprint paper	Pulpwood
	Billion bd.-ft.	*Billion bd.-ft.*	*Million tons* [1]	*Million tons* [1]	*Million cords*
IMPORTS					
1925	1.73	0.11	1.66	1.45	1.09
1930	1.15	.04	1.83	2.28	1.10
1935	.38	.06	1.93	2.28	1.04
1940	.61	.12	1.22	2.76	1.44
1945	.88	.16	1.75	2.67	1.73
1950	3.14	.28	2.39	4.86	1.83
1951	2.26	.25	2.36	4.96	2.51
1952	2.27	.21	1.94	5.03	2.31
1953	2.53	.23	2.16	5.00	1.55
1954	2.85	.21	2.05	4.99	1.60
EXPORTS					
1925	2.19	0.37	0.04	0.02	0.01
1930	1.91	.42	.05	.01	.13
1935	1.00	.31	.17	.02	.02
1940	.75	.17	.48	.04	.06
1945	.29	.12	.14	.04	.04
1950	.41	.11	.10	.04	.03
1951	.88	.12	.20	.07	.01
1952	.57	.16	.21	.11	.02
1953	.51	.13	.16	.05	.01
1954	.58	.13	.44	.14	.04

[1] 2,000 pounds.

Whether the United States will be able to increase its exports of timber products to help meet the widespread need in other parts of the world will depend on the relative needs of its own expanding economy. Domestic requirements as estimated for 1975 and 2000 will tax our own supplies to the utmost, even allowing for continued imports, at present levels, of pulp and paper and other special items. True, we hold a dominant position in the Free World's timber economy in terms of forest area, timber volume, productive capacity, and output of timber products. But our needs are great and will grow in response to our expanding population and other factors. Thus while we may be able to effect some slight increases in timber products for needy nations, it is unlikely that we will be able to expand our exports to any substantial degree, particularly if our own needs are as great as expected.

Relation of North American Forest Resources to Those of the Free World and World

A comparison of forest resources of North American countries is presented in table 193. It seemed desirable in these comparisons to rely on pertinent statistics for the different countries, appearing in other sections of this report, which are more or less similar to the standards adopted by the United States in reporting on its forest resources. However, comparison of resources between all countries and regions of the world must be on the basis of statistics which are reasonably comparable for the various countries considered. Thus world forest resource statistics as published by the Food and Agriculture Organization of the United Nations are used for this purpose. Because F. A. O. used different standards and definitions, the North American data used in world comparisons is somewhat different than North American data in table 193 and elsewhere in the Timber Resource Review.

A partial summary of these world statistics by country and region is given in table 194. Although these same statistics for North America and the Free World appear in tables 190 and 191 they are duplicated here in order that significant relationships between these and other parts of the world may be readily apparent.

United States Resources in Relation to Those of North America

About 1.8 billion acres or 36 percent of the land area of North America is forested, and slightly more than 60 percent (1.1 billion acres) of the forested area is considered commercial (table 193). The United States and Alaska have 48 percent of the commercial forest area, Canada 48 percent, and Mexico 4 percent. Whereas the United States and Alaska have a smaller acreage of softwoods than Canada, they have a greater proportion of the softwood volume—fifty-two percent as compared with 45 percent for Canada. Annual timber growth and cut are also much higher in the United States, where both growth and cut equal approximately 70 percent of the total for all of North America. Canada accounts for all but a small fraction of the remainder in both categories.

North American Resources in Relation to Those of the Free World

Both Latin America and Africa have more forest area than North America. But it is the relative distribution of the softwood resources among na-

TABLE 193.—*Forest resources of North America, 1953*

Item	United States	Alaska [1]	Canada [2]	Mexico	North America
	Million acres	*Million acres*	*Million acres*	*Million acres*	*Million acres*
Total land area	1, 904	366	2, 218	487	4, 975
Total forest land	648	136	951	64	1, 799
Total commercial forest land	485	44	529	49	1, 107
Softwood	230	33	396	16	675
Hardwood	255	11	133	33	432
Noncommercial forest land	163	92	422	15	692
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*
Timber volume on commercial forest land:					
Softwood	336	41	328	19	724
Hardwood	162	9	69	40	280
All Species	498	50	397	59	1, 004
Net annual timber growth [3]	14. 2	1. 0	[4] 4. 5	. 5	20. 2
Timber cut [3]	10. 8	([5])	3. 6	. 7	15. 1

[1] Combines Coastal and Interior Alaska.
[2] Excludes Labrador.
[3] Of growing stock on commercial forest land.
[4] Questionable estimate. Growth on the 190 million acres of commercial forest land under exploitation is estimated to be 2.4 billion cubic feet. Growth on areas not under exploitation is probably less than on areas now being exploited. If the stands were comparable, total growth on commercial forest land would be about 6.6 billion cubic feet. The estimate shown is about halfway between these two extremes.
[5] Less than 0.05 billion.

tions of the Free World that is most significant. Whereas North America has only 24 percent of the forested area, it has 76 percent of Free World's softwood forests, about 64 percent of softwood forests under exploitation, and about 70 percent of the softwood timber volume of forests being exploited. These and other relationships are shown below and in table 194.

	Forested area		
	Total (percent)	*Softwood types (percent)*	*Hardwood types (percent)*
North America	24	76	11
Latin America	29	4	35
Free Europe	4	11	2
Free Asia	14	7	16
Pacific Area	3	1	3
Africa	26	1	33
Total, Free World	100	100	100

	Forests under exploitation		
	Total (percent)	*Softwood types (percent)*	*Hardwood types (percent)*
North America	36	64	23
Latin America	10	4	13
Free Europe	13	25	7
Free Asia	25	5	34
Pacific Area	2	1	3
Africa	14	1	20
Total, Free World	100	100	100

	Timber volume on forests under exploitation		
	Total (percent)	*Softwood types (percent)*	*Hardwood types (percent)*
North America	34	70	15
Latin America	12	4	16
Free Europe	11	21	6
Free Asia	30	4	43
Pacific Area	1	1	2
Africa	12	---	18
Total, Free World	100	100	100

TABLE 194.—*Forest resources of the world, 1953*

Country or region	Total land area	Forested area		Accessible forests [1]	Forests under exploitation [2]			Growing stock (with bark) on areas under exploitation		
		Total all types	Softwood portion		All types	Softwood	Hardwood	All species	Softwood	Hardwood
	Million acres	*Million acres*	*Percent*	*Million acres*	*Million acres*	*Million acres*	*Million acres*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*
North America:										
United States	1,904	648	52	485	485	230	255	547	370	177
Alaska [3]	366	136	78	24	24	24	------	18	18	------
Canada [4]	2,218	951	75	370	190	142	48	255	199	56
Mexico	487	64	14	38	11	6	5	16	14	2
Total	4,975	1,799	65	917	710	402	308	836	601	235
Remainder of Free World: [5]										
Latin America	5,046	2,135	3	775	194	24	170	284	35	249
Free Europe	935	270	60	263	258	157	101	275	179	96
Free Asia	2,393	1,054	11	661	485	32	453	718	31	687
Pacific Area	2,113	212	9	49	42	5	37	35	7	28
Africa	7,339	1,980	(6)	702	267	5	262	283	4	279
Total	17,826	5,651	6	2,450	1,246	223	1,023	1,595	256	1,339
Total, Free World	22,801	7,450	20	3,367	1,956	625	1,331	2,431	857	1,574
U. S. S. R	5,410	1,833	78	1,050	867	743	124	1,166	1,054	112
European countries in Soviet Bloc [7]	249	66	52	66	63	33	30	75	40	35
Asiatic countries in Soviet Bloc [8]	4,175	244	75	108	89	67	22	122	96	26
Total, Soviet Bloc	9,834	2,143	77	1,224	1,019	843	176	1,363	1,190	173
Total, world	32,635	9,593	33	4,591	2,975	1,468	1,507	3,794	2,047	1,747

[1] All forests that are now within reach of economic management or exploitation as sources of forest products, including immature forests and managed forests where fellings are prohibited.

[2] Forests yielding industrial wood and/or fuelwood.

[3] Combines coastal and interior Alaska.

[4] Excludes Labrador.

[5] For included countries see references cited in footnotes to table 190.

[6] Less than 0.5 percent.

[7] Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, and Rumania.

[8] China, Manchuria, Tibet, North Korea, and Viet Minh.

Source: *World Forest Resources*, Food and Agriculture Organization of the United Nations, Rome, Italy, pp. 1–120, illus., 1955. Data for North America revised to agree with statistics for individual countries given in other parts of this report.

Thus, with such a large share of softwood resources, North American countries and particularly the United States occupy a dominant position in the Free World's timber economy. The United States alone has nearly 40 percent of the softwood area under exploitation in the Free World. It stands first among the nations of the world as a producer of industrial timber products. Its output in 1952 was 60 percent greater than that of free Europe and more than three times that of Canada.

The bulk of the hardwood forests are in Latin America and Africa, but these are not yet widely exploited. Latin America has only limited softwood resources but holds a dominant position among nations with respect to hardwoods. Thus, while it appears that Latin America does not constitute a potential source of softwood timber for the United States, supplementary supplies of quality hardwoods from this source may contribute somewhat toward filling gaps in our own supply picture.

North American and Free World Resources in Relation to Those of the World

The following tabulation and figure 107 give at a glance the relative distribution of the world's forest resources.

	Distribution of world forest resources		
	North America (percent)	*Free World (percent)*	*Soviet Bloc (percent)*
Total forested area	19	78	22
Softwood types	37	48	52
Hardwood types	10	92	8
Forests under exploitation	24	66	34
Softwood types	27	43	57
Hardwood types	20	88	12
Timber volume on forests under exploitation	22	64	36
Softwood	30	42	58
Hardwood	13	90	10

North America and the Soviet Bloc have about equal proportions of the forested area of the world. The Free World has nearly four-fifths of the total. The Free World also has about two-thirds of the forest area under exploitation and timber volume on such areas.

The softwood resources are largely confined to North America and the Soviet Bloc of countries. In comparison with North America, and in fact the entire Free World, the Soviet countries have a sizable margin in all softwood resource categories. With only 22 percent of the world forest area, they control more than half of the softwood forest area and 58 percent of the softwood timber volume on areas under exploitation.

Softwoods are in great demand in most parts of the world and are generally in short supply, especially in free Europe. At the present rate of cutting, the softwoods of free Europe could in all probability be fully utilized there and more too if additional supplies were forthcoming. The situation may be eased in time as more of the forest area is made accessible and as growing stock resources in countries depleted by war are built back to former levels. The free European softwood timber supply situation might also be considerably relieved if economic factors and government policy should permit a substantial resumption of imports from Soviet countries.

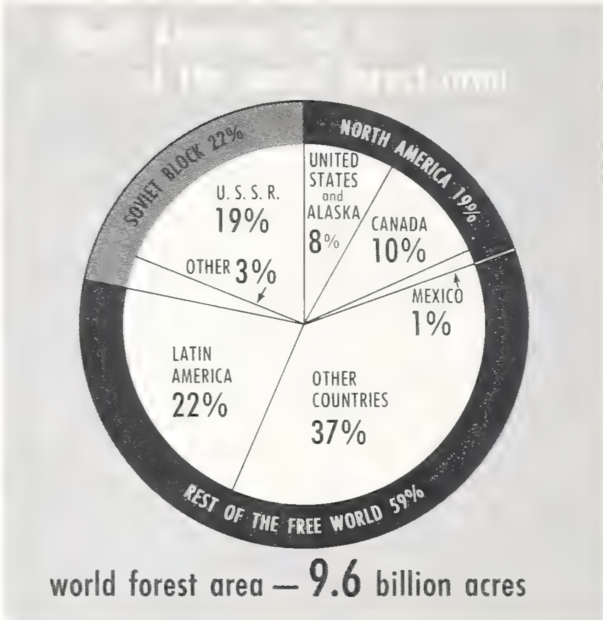

Figure 107

It appears that the United States may not be in a favorable position to expand its exports to any great extent, particularly if its own needs for timber are as great as expected. Canada, on the other hand, may well be able to expand its timber exports to the United States primarily in the form of pulpwood, woodpulp, and paper. However, the outlook for increased imports from Canada of softwood lumber of quality grades is not as encouraging over the long run.

The Soviet softwood resources are not yet being cut as heavily as those of the Free World. With more than half of the softwood area and timber volume, the Soviet countries provide only 40 percent of the world's softwood timber cut. Before World War II Soviet countries, particularly European Russia, contributed substantially to international timber trade.

However, Soviet softwood resources are not likely to enter world trade on the scale that might be inferred from the statistics on their magnitude. Much of the Soviet Bloc softwood resource is situated in the very cold and relatively inacces-

sible north country. High costs of logging and transportation may keep a considerable part of this resource economically inaccessible for a long time. Furthermore, it is possible that the expanding economies of the Soviet countries will require most of the timber that can be economically harvested and processed.

All in all, despite the vast extent of Soviet softwood forests, it is unlikely that any substantial volume of Soviet timber would reach markets in the United States even though trade between the Soviet Bloc and free-world countries were unrestricted. In any event timber products from the United States should be able to compete in other parts of the world with similar products from Soviet countries, should other factors favor an expansion of timber-products export from this country.

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Future Demand for Timber

CONTENTS

FUTURE DEMAND FOR TIMBER

James C. Rettie
Dwight Hair

INTRODUCTION

Preceding sections have dealt with the Nation's supply of timber and with certain factors affecting that supply. In the present section, attention is directed to the demand for timber, especially the quantities of timber that might—under various explicit and reasonable assumptions—be demanded by the United States economy in the year 1975 and in 2000. Long-range demand projections are indispensable for intelligent timber policy and program formulation, both private and public, because the growing of timber from seedling to merchantable tree is an enterprise that extends over periods of 20 to 100 years or more.

The approach is to obtain first an overall view of how the Nation's economy is likely to expand over the next 20 years and the next 45 years. This involves consideration of probable increases in population and in goods-and-services output and raw-materials input. Second, attention is given to the place of timber products in the economy as indicated by past trends in consumption. From these and from price and other considerations, projections of future end uses of each of the major timber products are developed. With the outlook for their end uses determined, it is then possible to estimate projected demands for timber products. Finally, after allowing for net imports and anticipated improvements in timber utilization, the projected demands for timber products are translated into projected demands for live sawtimber and growing stock on commercial forest land.

ANTICIPATED GROWTH OF THE NATION'S ECONOMY BY 1975 AND 2000

Forecasts as to the probable size of the Nation's economy 10 to 20 years hence have been made by a number of agencies.[62] Insofar as 1975 is concerned, the economic projections made for the Timber Resource Review are generally in line with those made by others. With respect to the year 2000, it has been necessary to make independent projections because other agencies have not extended their estimates that far.

The reliability of any projection tends, of course, to become less the farther it is extended into the future. There is an ever-increasing risk that it may turn out to have been much too high or much too low. In most of the long-term projections so far made and tested by time, the principal fault has been that they have fallen short of the growth actually experienced. Some of the projections developed in this study are probably subject to the same tendency. Yet no long-term projection is an irrevocable commitment. It can be reviewed and revised at any time.

The following appraisal of the probable size of the Nation's economy by 1975 and 2000 is necessarily technical and quite detailed. If the reader does not wish to go into the detail of probable increases in population, and in goods-and-services output and raw-materials input, he should pass over this discussion and turn to the portion of the report dealing with the Basic Assumptions, page 369. Nevertheless, this background on anticipated growth of the economy will contribute significantly to better understanding of the projections of timber demand and is recommended.

THE POPULATION UPSURGE HAS NOT ABATED

The unexpected upsurge in the birth rate, beginning in the early 1940's and continuing through 1955, has made a shambles of the population pro-

[62] Joint Committee on the Economic Report, U. S. Congress. *Potential Economic Growth of the United States During the Next Decade.* Washington, D. C. 1954.

The President's Materials Policy Commission. *Resources for Freedom.* Vols. I–V. Washington, D. C. 1952.

Colm, Gerhard, and Young, Marilyn. *The American Economy in 1960.* National Planning Assoc., Washington, D. C. 1952.

Dewhurst, J. Frederick, and Associates. *America's Needs and Resources.* The Twentieth Century Fund, New York, N. Y. 1955.

National Bureau of Economic Research. *Long-Range Economic Projections.* Princeton Univ. Press, Princeton, N. J. 1954.

Owen, Wilfred. *A Mid-Century Look at Resources.* The Brookings Institution. Washington, D. C. 1954.

jections commonly accepted 10 to 20 years ago.[63] Instead of leveling off at 165 to 180 million, as then foreseen for the period 1965–75, the population has already passed that lower limit. There is now a practical certainty that 1965 will witness the beginning of another surge of births when people born after 1940 will be having families of their own. The infusion of younger-age persons into the population structure, which has occurred since 1940, and the second infusion that will begin about 1960–65, will almost certainly keep the Nation's population on the upward trend until 2000 and beyond.

The trend of future population is important because it provides the foundation for estimates of future labor force, future gross national product, future disposable income of individuals, and other elements of economic growth affecting demand for timber products.

Future Population Depends Chiefly On Future Birth Rates

In 1955, the Bureau of the Census published four series of population projections for the United States, covering the period 1955 through 1975 (table 195). The differences between the various series are due entirely to differing future birth rates. The rates of mortality and net immigration are the same for all four series.[64] According to the Census Bureau, all of the future population series are reasonably possible, and none is selected as "most likely." Acceptance of the high series, the low series, or something in between, obviously depends chiefly upon the evidence that would support the various birth-rate (fertility-rate) assumptions.[65]

[63] See for example: Davis, Joseph S. *The Population Upsurge in the United States.* Food Res. Institute, Stanford Univ., Palo Alto, Calif. 1949.

[64] Briefly, it was assumed that the age-specific mortality rates would continue to decline until 1955–60 and remain constant thereafter until 1975—a conservative assumption. Net immigration would continue about the same as it has since the end of World War II.

[65] The method of projection used by the Census Bureau is based on the application of "age-specific fertility rates," or number of births annually per 1,000 women in each 5-year age group:

Age group (years)	*1950–53*	*1954–55*	*"Prewar" (approximate)*	*Percentage increase 1954–55 over "prewar"*
Under 19	87.9	87.5	61.2	43
20 to 24	213.4	232.5	152.3	53
25 to 29	176.0	195.0	135.4	44
30 to 34	109.5	122.2	81.1	51
35 to 39	56.2	60.2	38.8	55
40 and over	17.1	16.5	11.4	45

The age-specific fertility rate assumptions underlying the projections are as follows:

Series AA: The 1954–55 rates remain constant from 1955 through 1975.

Series A: The 1950–53 average rates remain constant to 1975.

Series B: The 1950–53 average rates remain constant until 1965, then drop on a straight line to the "prewar' rates by 1975.

Series C: The 1950–53 average rates drop on a straight line to the "prewar" rates by 1975.

Acceptance of a particular population series is also contingent upon at least two theories. One is that fertility rates tend to rise and fall in a pattern of long cycles; the other is that there is a natural propensity for parents to want 3 or 4 children, and that they will tend to have that many if economic and other conditions are favorable. Some evidence by which either of these theories could be supported is to be found in trends in what the population analysts call the "reproduction rates" (table 196).

A significant feature of the trend in female gross reproduction rates[66] is that the high rate of 1954 was not quite up to the 1905–10 average. This could be interpreted as evidence that the propensity to have children has been no stronger in recent years than it was at the beginning of the century. The prewar decline in the gross rate has been ascribed to the large shift of population from rural to urban. But the same shift has continued while the rate has been rising. The contemporary shift of population from congested urban districts to suburban areas also may have had some influence. If so, such influence is likely to be permanent as dispersion of congested urban population continues.

The female net reproduction rate[67] since the end of World War II has been much higher than it was at the beginning of the century because of great reduction in mortality rates. The relationship of the net rate to the gross rate has changed from 0.745 in 1905–10 to 0.960 in 1954, due entirely to the decrease in mortality of females. Some moderate further decrease is to be expected.

One important question is whether families of the future would willingly support the number of children that each, on the average, would have at the current fertility rate. Such a question is not answerable in any definitive way, but if the 1954 rate is maintained, each woman in the course

[66] The "female gross reproduction rate" represents the number of daughters that would be born to the average 1,000 newly born females if (a) none of them were to die before completing their reproductive period of life, and (b) they were subject to the age-specific fertility rates prevailing at a specified period in time. A gross reproduction rate of 1,000 means that, under these conditions, the 1,000 females would bear just enough daughters to replace themselves. The gross reproduction rate may be roughly indicative of the propensity to bear children and of the changes in that propensity over time.

[67] The "female net reproduction rate" represents the number of daughters that would be born to the average 1,000 newly born females if (a) they were subject, from birth to completion of their reproductive period of life, to the age-specific mortality rates prevailing at a specified period in time, and (b) they were subject to the age-specific fertility rates of that same period. Thus a net reproduction rate of 1,000 means that, under these conditions, the 1,000 females would bear just enough daughters to replace themselves. At rates of less than 1,000, the Nation's population—if not replenished by net immigration—would ultimately decrease. The net reproduction rate current at a particular time is the *effective* rate of reproduction implied by the then-current fertility and mortality rates.

TABLE 195.—*Population of the United States at beginning and end of specified periods with average annual rate of increase, and Census Bureau projections 1955 to 1975 with implied rates of increase*

Item and period	Population [1]		Average annual rate of increase [2]
	At beginning of period	At end of the period	
	Million persons	*Million persons*	*Percent*
Census enumerations:			
1800–50	5. 3	23. 2	2. 99
1850–1900	23. 2	76. 1	2. 40
1900–30	76. 1	123. 2	1. 62
1930–40	123. 2	132. 1	. 79
1940–50	132. 1	151. 7	1. 39
Census estimates,[3] 1950–55	151. 7	165. 3	1. 74
Census projections,[4] 1955–75:			
Series AA	165. 3	228. 5	1. 63
Series A	165. 3	221. 5	1. 47
Series B	165. 3	214. 6	1. 31
Series C	165. 3	206. 9	1. 13

[1] Census Bureau's estimates of the July 1 population from 1900 onward.
[2] Computed from figures in thousands before rounding.
[3] Bureau of the Census. *Provisional Estimates of the Population of the United States.* Current Population Rpts. Ser. P–25. Aug. 1956.
[4] Bureau of the Census. *Revised Projections of the Population of the United States, 1960 to 1975.* Current Population Rpts. Ser. P–25, No. 123. Oct. 1955.

of her reproductive period of life would be expected on the average to bear 1.654 daughters and about 1.679 sons [68]—a total of 3.333 children. Assuming that 15 percent for one reason or another do not bear children, the average for the remaining 85 percent of the female population would be 3.921 or slightly less than four children. Families of that average size, in an economy of high-level employment, do not appear to be beyond the realm of reasonable probability.

With more pensions and other forms of old-age security, the senior members of the population will be less dependent on their adult offspring than they have been in the past. That will tend to increase the income which young and middle-age families will have for support of children. These lines of reasoning tend to show that the upper population projections are not at all improbable.

The lower series are, of course, contingent on falling fertility rates. Whether or not low rates in the past have been a consequence of economic depression, there certainly is some justification

[68] About 100.0 males are born for every 98.5 females.

TABLE 196.—*Female reproduction rates* [1] *in the United States, specified periods and years, 1905–54*

[DAUGHTERS PER 1,000 FEMALES]

Year or period	Gross rate	Net rate	Year	Gross rate	Net rate
1905–10	1, 793	1, 336	1945	1, 212	1, 132
1921–25	1, 318	1, 104	1946	1, 430	1, 344
1926–30	1, 168	1, 004	1947	1, 593	1, 505
1930–35	1, 108	984	1948	1, 514	1, 435
1935–40	1, 101	978	1949	1, 515	1, 439
1940	1, 121	1, 027	1950	1, 505	1, 435
1941	1, 168	1, 075	1951	1, 591	1, 519
1942	1, 277	1, 185	1952	1, 635	1, 561
1943	1, 323	1, 228	1953	1, 665	1, 594
1944	1, 249	1, 163	1954	1, 723	1, 654

[1] See text footnotes 66 and 67 for definition of gross and net reproduction rates.

Source: *Statistical Abstract of the United States*, 1956, and *Vital Statistics of the United States*, 1954. Net rates for 1921–25 and 1926–30 estimated on basis of reported gross rate.

for the belief that marriages were postponed during the 1930's and that married couples postponed having as many children as they would have desired. This is probably one of the important factors contributing to the high fertility rates since the end of World War II. If so, some moderate decrease in the fertility rates might be expected in the next 10 to 20 years.

On the other hand, the assumption of no further decline in mortality rates after 1955–60 is not entirely realistic. There are real probabilities that medical science will discover far better methods for the prevention and control of diseases affecting older people. If this does occur to any important extent, the effect on population may offset any moderate decline in fertility. Acceptance of the upper projections is not wholly contingent upon maintenance of the recent high fertility rates.

Census Bureau's Projections Extended

The Census Bureau's series of population projections to 1975 are here extended to 2000. For each series, the Bureau's 1975 assumptions with respect to age-specific fertility rates, age-specific mortality rates, and net immigration are held constant from 1975 onward. Using the Census' method, the results of the extension are as follows:

Series:	*Projection to 1975 (million persons)*	*Extension to 2000 (million persons)*	*Average annual rate of increase (percent)*
AA	228. 5	360. 0	1. 83
A	221. 5	320. 0	1. 48
B	214. 6	275. 0	1. 00
C	206. 9	250. 0	. 76

While the logic of making these extensions by holding all factors constant from 1975 onward may appear to be rather questionable, the results that would have been obtained by variations of the assumptions would have covered about the same range of possibilities. If, for example, the fertility rates for Series AA and Series A had been lowered somewhat, it would have been equally logical to lower the mortality rates progressively from 1955–60 onward. These two adjustments would tend to offset each other.

Population Figures Chosen for Use in This Study

The population projections used in this analysis of timber demand are the Census Series B and AA as published for 1975 and as extended to 2000:

	1975 (million persons)	2000 (million persons)
Series B and its extension	215	275
Series AA and its extension	228	360

While it might be argued that one projection of timber demand should logically be based on Series C, or that an upper projection should rest on Series A rather than Series AA, choice of assumptions is a matter of judgment. In view of the current outlook for fertility and mortality rates, the lowest series is rejected. The AA series is selected over Series A in order to indicate the upper realm of current population-growth possibilities.

With reference to 1952 population, the increases projected are 37 or 45 percent to 1975 and 75 or 129 percent to 2000. The latter percentages bracket the change that occurred in the first half of this century. Between 1900 and 1950 the Nation's population grew from 76 million to 152 million, or 100 percent.

Output of All Goods and Services Will Greatly Increase

Total annual output of all goods and services, or gross national product, has more than doubled at 25-year intervals throughout the past century. Barring the outbreak of atomic warfare, or some other disaster of that magnitude, there is every reason to expect that gross national product will continue to increase. The extent of the increase will largely determine future requirements for raw materials, including timber products. To gage the increase, several factors must be considered: The size of the labor force, the length of the workweek, and average productivity per man-hour.

Size of Labor Force Determined Chiefly by Size and Age-Distribution of Population

The portion of the population in the labor force [69] varies somewhat from time to time. There is a marked difference between the percentage of men and women who participate. There are also marked differences in the participation rates of various age groups of both sexes. In 1955, for example, 82 percent of men 14 years of age and older were in the labor force,[70] and 35 percent of women:

Age group:	Male (percent)	Female (percent)
14–19	49. 0	29. 7
20–24	89. 5	45. 8
25–34	96. 5	34. 8
35–44	96. 9	41. 4
45–54	95. 1	43. 5
55–64	86. 4	32. 2
65 and over	38. 5	10. 3
14 and older	82. 3	34. 5

Looking ahead into the future, it is probably safe to anticipate some moderate decrease in the participation rates of young people as the result of increased schooling. Also, there may be some comparable decrease in the rates of persons beyond the age of 55 attributable to pension and retirement systems now established or that will be established. This tendency might, of course, be offset by medical discoveries which would improve the health of older people and thereby make retirement less attractive for many.

With a Series B population of 215 million by 1975 and 275 million by 2000, with the age and sex distribution implicit in these projections, and with participation rates considerably reduced as suggested above, the labor force may amount to about 85 million by 1975 and to about 110 million by 2000. The reduction for increased schooling is less for 2000 than for 1975 because the 2000 population projection contains a smaller percentage of persons of school age.

If population should grow at the much faster rate implied by Series AA, the future labor force would also be much larger. With 228 million people by 1975 and 360 million by 2000, the same method of estimation indicates labor forces of 86 million and 133 million. The comparatively

[69] The labor force includes that portion of the population 14 years of age and older that is: (a) productively engaged in all types of civilian economic activity, (b) serving in the Nation's armed forces, and (c) out of employment but available for and willing to accept employment.

[70] Bureau of the Census. *Annual Report of the Labor Force 1955*. Current Population Rpts. Ser. P–50, No. 67, p. 4. March 1956. (Adjusted to total population basis.)

small difference in the two 1975 labor force estimates is due to the fact that the labor force of that time will consist almost entirely of persons born prior to 1960. Whatever the population of the future may be, it can have very little effect upon the size of the labor force until after 1975.

Possible Distribution of Future Labor Forces

Proceeding from the total-labor-force projections, it is necessary to make several corollary assumptions as to how those future labor forces would likely be engaged.

On the assumption that military preparedness will continue, the United States is expected to maintain its military forces near their present manpower strength—perhaps 3.5 million persons by 1975 and 4.0 million by 2000. However, these figures indicate a decreasing percentage of the total labor force.

Another basic assumption is that the Nation's economy will continue to function at a high level of employment. This does not mean that there will be no unemployment or minor cyclical fluctuations, but it does rule out major depressions like that of the 1930's. People change employment when they desire; often they are unemployed between jobs. Technological and other changes in industry may result in temporary or permanent layoffs. The degree of unemployment may be somewhere in the neighborhood of 3 to 4 percent of the labor force. The figure of 4 percent is used here. At that rate, the number of unemployed in 1975 would be about 3.5 million, regardless of which of the two labor-force projections is used, and the number of employed civilians would then be 78 million. In the year 2000 with the total labor force at 110 million, unemployment would be about 4 million and employed civilians about 102 million; with the total labor force at 133 million and allowing for around 5 million unemployed, the employed civilians would number 124 million.

Finally, with no clear evidence that any great change in Federal, State, and local governmental services is in prospect, it has been assumed that civilian employment in the private sector of the economy will remain at about 90 percent—and in the government sector 10 percent—of the employed civilian labor force, about as it is today. Taking this factor into account, the private civilian labor force projected to 1975 would be 70 million with a Series B population or 71 million with Series AA. Projected to 2000, the corresponding numbers become 92 million and 112 million.

Annual Average Workweek Is Shortening

Fifty years ago the usual workweek in private industry was 54 to 60 hours; in agriculture it was even longer. By 1929 most industrial workers were putting in about 48 hours on the job and by 1954, the average in manufacturing was 39.5 hours, including the time of persons who, for one reason or another, did not spend full time on the job.[71] (The hours scheduled for work were somewhat more.) In agriculture the workweek has also shortened but not to the same extent. For 1953, it has been estimated that the workweek in agriculture averaged 47.4 hours, compared to a weighted average workweek in all private employment of 40.2 hours.[72]

It is reasonable to expect that the standard 40-hour week of scheduled work will have become almost universal by 1975. Observance of 7 conventional holidays will certainly continue. There will be more earned vacations and sick leave. If earned vacations average 15 days and sick leave or other time off averages 10 days, the average workyear would be approximately 1,820 hours or 35 hours per week. If earned vacations and other leave do not increase to the extent here suggested, there is likely to be some further shortening of the standard 8-hour day or of the standard 5-day week. In either case, an average workweek of 35 hours by 1975 is quite possible.

Looking ahead to the year 2000, further shortening of the workweek is to be expected. If the scheduled workday is shortened to 7 hours, with earned vacation and other leave in the amount suggested above, the workyear would average about 1,600 hours or 30.8 per week. Reduction of the standard workweek to 4 days of 8 hours per day, with the same earned vacation and other leave, would shorten the workyear to about 1,400 hours or about 27 per week. Regardless of how the hours will be shortened, it appears that the workyear in 2000 will not exceed 1,560 hours or 30 per week.

For purposes of gross national product projections, to which this discussion is leading, these average annual workweeks, 35 hours in 1975 and 30 hours in 2000, are assumed. If hours of work are not reduced to this extent, gross national product may exceed the projections that will presently be made.

[71] Bureau of Labor Statistics, U. S. Department of Labor. *Economic Forces in the U. S. A.* In *Facts and Figures*, p. 23. Washington, D. C. 1954.

[72] Joint Committee on the Economic Report, U. S. Congress. *Potential Ecnomic Growth of the United States During the Next Decade.* Washington, D. C. 1954. (From data contained in table 1, p. 4.)

Average Man-Hour Productivity Is Increasing

Estimates of man-hour productivity, available only for the private sector of the economy, are measured in terms of physical output of goods and services per man-hour of labor input. An increase in man-hour productivity reflects not only improvement in the efficiency of labor, but also improved efficiency in the utilization of basic natural resources and of capital equipment of all kinds.[73]

Estimates of man-hour output in the private sector of the United States economy show rapid and sustained increases (table 197). Compared to the 1910–14 average, $1.11, the 1949–53 average ($2.49) indicates a productivity increase averaging 2.09 percent compounded annually. The average annual rate of increase between 1940 and 1953 was 2.52 percent. The possibility that productive efficiency will continue indefinitely to increase at a rising compound rate is hardly conceivable. The man-hour output curve is more likely to level off. The problem is when.

Technological factors favor a further stepup in the rate of increase. Substitution of mechanical energy for human energy, automation, electronics, and many other developments may bring rapid increases in man-hour output. On the other hand, scarcity and higher cost of basic raw materials may retard the rate of increase. The United States' dependency on foreign raw materials is likely to increase substantially in the next 20 to 45 years.[74] Meanwhile other nations will also be stepping up their demands. Competition will intensify and a larger portion of productive effort will have to go into extraction of nonreplaceable low-grade raw materials and into the production of those which are replaceable. This means more effort per unit of finished product.

Various productivity assumptions have been made in connection with other projections of gross national product. Colm, for example, assumed that man-hour productivity will increase at the rate of 2.5 percent annually during the decade 1950–60.[75] The President's Materials Policy Commission assumed a rate of 2.5 percent for the period 1950–75.[76] The Staff of the Joint Committee on the Economic Report for 1953–60 assumed a rate of 2.8 percent.[77] The Stanford Research Institute, on the other hand, has made a gross national product projection which implies that man-hour productivity will increase at the rate of only 1.42 percent annually during the period 1953–75.[78]

TABLE 197.—*Estimated average physical output per man-hour in the private sector of the United States economy, 1910–53*

[At constant 1953 prices]

Year	Dollars	Year	Dollars	Year	Dollars
1910	1.06	1925	1.44	1940	1.91
1911	1.07	1926	1.46	1941	2.01
1912	1.15	1927	1.46	1942	2.01
1913	1.12	1928	1.46	1943	2.03
1914	1.13	1929	1.49	1944	2.17
1915	1.12	1930	1.44	1945	2.24
1916	1.13	1931	1.48	1946	2.15
1917	1.11	1932	1.42	1947	2.13
1918	1.11	1933	1.38	1948	2.23
1919	1.21	1934	1.51	1949	2.30
1920	1.21	1935	1.62	1950	2.47
1921	1.19	1936	1.67	1951	2.49
1922	1.28	1937	1.72	1952	2.56
1923	1.35	1938	1.76	1953	2.64
1924	1.37	1939	1.82		

Source: Joint Committee on the Economic Report, U. S. Congress. *Potential Economic Growth of the United States Economy During the Next Decade.* Table B–3, p. 34. Washington, D. C. 1954.

It is assumed here that the average annual increase of man-hour productivity during the period 1949–53 to 1975 will be 2.5 percent and that between 1975 and 2000 it will average just over 2.0 percent. At those rates, man-hour output in 1953 prices will increase from the 1949–53 average of $2.49 to $4.50 by 1975 and to $7.50 by 2000.

Gross National Product Projections

With a population of 215 million in 1975 and 275 million in 2000—and taking into account corollary assumptions about the labor force, the workweek, and private man-hour productivity—the Nation's annual output of all goods and services, valued at 1953 prices, is expected to increase from the 1955 level of $380.7 billion to about $630 billion by 1975, and to about $1,200 billion by 2000 (table 198). The increases are 65 percent during the forthcoming 20 years and 215 percent in the next 45 years.

With a population of 360 million by 2000 and with a bigger labor force, but other assumptions remaining the same, a gross national product of $1,450 billion is anticipated. The increase would be 281 percent.

[73] Kendrick, John W. *National Productivity and Its Long-Run Projection.* In Natl. Bur. Econ. Res. *Long-Range Economic Projection,* pp. 67–104. Princeton Univ. Press, Princeton, N. J. 1954.

[74] The President's Materials Policy Commission. *Resources for Freedom.* Vol. I. Washington, D. C. 1952.

[75] Colm, Gerhard, and Young, Marilyn. *The American Economy in 1960,* p. 19. National Planning Assoc., Washington, D. C. 1952.

[76] Publication cited, Vol. II, p. 111.

[77] Publication cited. Rate derived from table 1, p. 19.

[78] Stanford Research Institute. *America's Demand for Wood 1929–75.* Weyerhaeuser Timber Co., Tacoma, Wash. (Rate derived from table 1, p. 12.)

TABLE 198.—*Projections of gross national product to 1975 and 2000*

[Dollars at 1953 prices]

Item	Unit of measure	Series B population		Series AA population	
		215 million in 1975	275 million in 2000	228 million in 1975	360 million in 2000
Private employment	Million man-years	70	92	71	112
Average workyear	Hours	1, 820	1, 560	1, 820	1, 560
Hours of employment	Billion man-hours	127, 400	143, 500	129, 200	174, 700
Product per man-hour	Dollars	4. 50	7. 50	4. 50	7. 50
Private gross national product	Billion dollars	570	1, 080	580	1, 300
Total gross national product [1]	do	630	1, 200	645	1, 450

[1] Assuming that gross national product from the private sector of the economy will be about 90 percent of total gross national product.

By way of comparison, the actual increase in gross national product over the past 45 years (1910 to 1955)—in spite of two world wars and a major depression—amounted to 262 percent.[79]

PER CAPITA DISPOSABLE INCOME MAY DOUBLE BY 2000

Gross national product contains a number of components. One that is extremely useful in projecting some of the end uses of timber is disposable personal income, i. e., monetary income of private persons after payment of direct personal taxes. Between 1929 and 1955, disposable personal income per capita, in 1953 dollars, increased 50 percent. A further large increase can be expected during the next 45 years. What that increase may be depends partly on future levels of gross national product, of population, and of taxation.

In the early 1930's, disposable personal income averaged more than 80 percent of gross national product. But in the 1950's, it has averaged less than 70 percent (table 199). For the future, the basic assumption of military preparedness implies no large cut in personal taxation. Furthermore, prospective growth of the population will necessitate increased expenditures for education, highways, and other public services. Hence it appears reasonable to assume that disposable personal income will remain at about 70 percent of gross national product. Projections made on that basis (table 200) imply that per capita disposable income will increase 38 or 31 percent by 1975 and 101 or 86 percent by the year 2000.

The implications of this much increase in the average buying power of individuals over the next 45 years are obvious. People will want more

[79] Gross national product of 1910, valued at 1953 prices, is estimated at $105.1 billion. See Joint Committee on the Economic Report, publication cited, table B-4, p. 35.

TABLE 199.—*Disposable personal income as percent of gross national product, 1929–55*

[Derived from current-dollar estimates]

Year	Percent	Year	Percent	Year	Percent
1929	79. 6	1938	77. 1	1947	72. 8
1930	81. 6	1939	77. 3	1948	72. 9
1931	83. 7	1940	75. 6	1949	73. 1
1932	83. 2	1941	73. 9	1950	72. 3
1933	81. 7	1942	73. 8	1951	68. 9
1934	80. 0	1943	69. 4	1952	68. 4
1935	80. 4	1944	69. 4	1953	68. 5
1936	80. 0	1945	70. 4	1954	70. 7
1937	78. 2	1946	76. 1	1955	[1] 69. 5

[1] Preliminary.

Source: U. S. Department of Commerce. *National Income, 1954,* p. 22–23; and *Economic Report of the President,* 1956, pp. 165 and 170.

TABLE 200.—*Disposable personal income in 1952 with projections to 1975 and 2000*

[In 1953 dollars]

Year	Population	Gross national product	Personal disposable income	Per capita disposable income	Per capita increase over 1952
	Million persons	*Billion dollars*	*Billion dollars*	*Dollars*	*Percent*
1952	157	354	[1] 238	[1] 1, 517	
1975	215	630	441	2, 100	38
1975	228	645	452	1, 982	31
2000	275	1, 200	840	3, 055	101
2000	360	1, 450	1, 015	2, 819	86

[1] *Economic Report of the President, 1954,* p. 178. Washington, D. C. 1954.

adequate and better quality housing, more goods and services of all kinds, and more public facilities. The production of goods and services to meet such demands will certainly entail a large expansion of industrial plant and equipment. Expenditures for new construction and other elements of economic growth having a direct influence upon demand for timber products will be strongly affected.

Raw Materials Input Will Increase

As the economy expands, more raw materials will be required. How much more is a pertinent question because future demand for timber will certainly bear some relationship to future demand for raw materials in general.

Raw materials are of three main types: Food materials, energy materials, and physical-structure materials. Fuelwood is the only timber product that is an energy material. The physical-structure materials [80] are those which provide the substance of things we make and use. They include, for example, all the metals except gold, all the nonmetallic-nonfuel minerals, all the fibers, and all timber products except fuelwood.

In order to observe input relationships and trends for these broad classes of materials, a common input unit [81] is used (table 201). With it, annual inputs of all physical-structure materials can be compared with gross national product (GNP).

The relationship of physical-structure materials input to gross national product has been fairly consistent, but there has been some variation, possibly due to timelags between input and output or to errors in the input estimates (fig. 108). Other influences that would account for variability are economic depression and war. During times of economic distress, it is quite probable that

TABLE 201.—*Inputs of physical-structure materials, 1900–1952*

Year	Total input	Input per million GNP dollars [1]	Year	Total input	Input per million GNP dollars [1]
	Million units	*Units*		*Million units*	*Units*
1900	1, 979	--------	1927	3, 092	183
1901	1, 915	--------	1928	3, 327	197
1902	2, 375	--------	1929	3, 455	194
1903	2, 231	--------	1930	2, 967	184
1904	2, 496	--------	1931	2, 883	191
1905	2, 453	--------	1932	2, 054	160
1906	2, 635	--------	1933	2, 131	173
1907	2, 427	--------	1934	1, 834	136
1908	2, 425	--------	1935	2, 619	172
1909	2, 621	255	1936	2, 900	171
1910	2, 760	263	1937	3, 985	218
1911	2, 641	251	1938	3, 037	175
1912	2, 767	241	1939	3, 490	186
1913	2, 636	233	1940	4, 026	197
1914	2, 905	259	1941	4, 908	208
1915	2, 587	234	1942	4, 993	188
1916	2, 856	241	1943	4, 460	151
1917	3, 090	247	1944	4, 706	147
1918	2, 875	218	1945	4, 173	133
1919	2, 678	204	1946	4, 379	157
1920	3, 242	255	1947	4, 592	166
1921	2, 130	191	1948	5, 506	190
1922	2, 611	202	1949	4, 944	172
1923	3, 209	221	1950	5, 174	164
1924	3, 069	212	1951	5, 276	157
1925	3, 331	210	1952	5, 933	169
1926	3, 432	207			

[1] Input per million GNP dollars based on series (in 1953 constant dollars) contained in *Potential Economic Growth of the United States During the Next Decade.* Joint Committee on the Economic Report, p. 35. Washington, D. C. 1954. Estimates of GNP in 1953 dollars not available for years prior to 1909.

Source: Bureau of the Census. *Raw Materials in the United States Economy: 1900–1952,* pp. 80–81. Washington, D. C. 1954.

[80] The term "physical-structure materials," designating all the nonfood-nonfuel raw materials, was first used by the Bureau of the Census in its publication *Raw Materials in the United States Economy: 1900–1952,* Washington, D. C. 1954. While the term may not be the best that might be found (because of the tendency to associate such words with building material only), there is precedent for retaining it. Various others so far considered as substitutes for the Census Bureau's term appear no better.

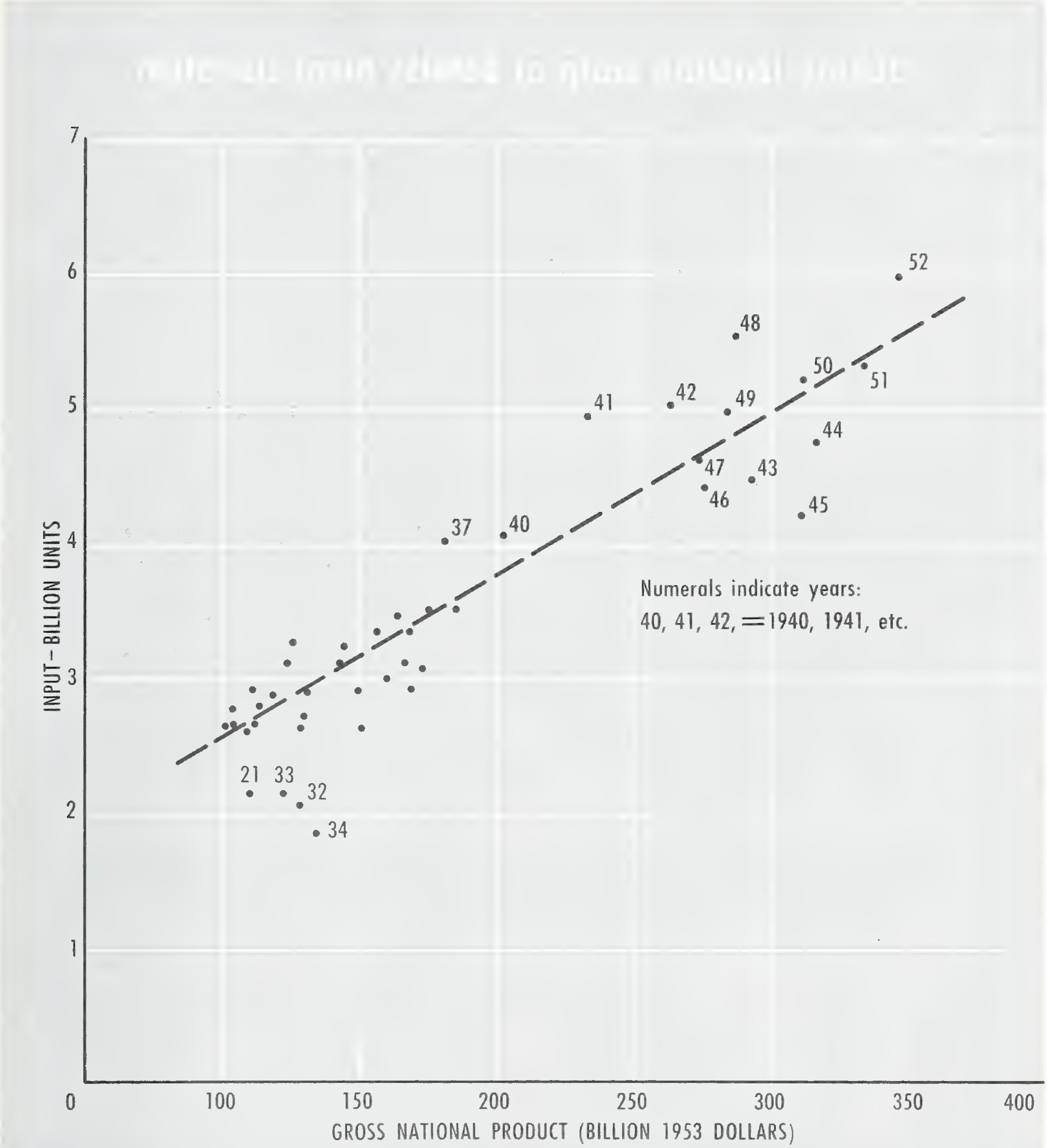
[81] Cubic feet of timber, tons of mineral ore, and bales of cotton cannot be compared with each other nor added together into a total. Converting the various units of measure to a common conventional unit (such as tons or cubic feet) would not suffice. Some materials have high value per unit of quantity and others have low value. Measurements of a heterogeneous collection of materials that take no account of relative values have little significance.

The President's Materials Policy Commission and the Bureau of the Census convert conventional units to a common unit which does recognize differences in value. This is the quantity of each material which could have been bought for one dollar at its 1935–39 national average price, what might be called a "constant-dollar quantity unit." But instead of using such a cumbersome expression, the raw-materials input estimates available from these agencies are here referred to simply in terms of "units."

The prices used in constructing the input unit estimates were those prices applicable after the first major step in production—timber products as logs and bolts at roadside or minerals at the mine ready for shipment, for example. Prices as of some later period would now be preferable, but any reworking of input data is a job that only the Census Bureau could undertake.

The conversion of inputs from their conventional units of measure to input units was done product by product to minimize distortions that otherwise arise from changes in the composition of any broad class of materials. Timber, for example, was treated as four separate products—saw logs for lumber, pulpwood, fuelwood, and "all other." Materials imported for consumption as finished or semifinished goods were converted to equivalent quantities of their constituent raw materials.

The input data are taken from the revised series published by the Bureau of the Census in *Raw Materials in the United States Economy: 1900–1952.* Washington, D. C. 1954.



Source: U.S. Department of Commerce

Figure 108

consumer purchases of goods made from the physical-structure materials are curbed more drastically than purchases of foods, fuel materials, and services. It is equally probable that military mobilization has the opposite influence.

Since it is assumed that depression and war will be avoided during the next 45 years, the general trend of the relationship of physical-structure materials input to gross national product is relevant. Using the estimating equation represented by the trend line in figure 108, a first approximation of the expected inputs of these materials is obtained as follows:

Year:	GNP (billion dollars)	Inputs (billion units)
1975	630	8. 8
1975	645	9. 0
2000	1, 200	15. 5
2000	1, 450	18. 5

Compared to 1952, the 1975 estimates represent increases of 48 and 51 percent; for 2000, they are are 161 and 211 percent higher.

Increased materials input will certainly put much heavier pressure on supply, stimulating more complete utilization of new raw materials, and more recycling of used materials. Such trends in conservation of new materials have been in effect for some time, and to that extent they are reflected in the estimates cited above. But there is a real probability that far more strenuous effort to conserve new materials will be forthcoming. What future savings of new raw materials (over and above what would accrue from continuation of past trends) are likely to be can hardly be estimated statistically. But it is conservative to make rather generous allowances for savings—particularly in the period beyond 1975. Therefore, the first approximations of future physical-structure materials input are adjusted downward[82] as shown in table 202. Compared to 1952, the adjusted 1975 increase becomes 40 percent if population is 215 million and 43 percent if population reaches 228 million. The 2000 increases are 105 percent with 275 million persons and 148 percent with 360 million.[83]

[82] The adjusted figures represent approximately the levels of input to be expected if the 1900–1952 average annual rate of increase in per capita input continues until the year 2000. That rate was 0.53 percent compounded. One of the difficulties in the logic of this approach to estimation of future inputs is that per capita input did not increase during the first half of the period 1900–1952. All of the increase occurred in the latter years when it was much higher than the average for the period as a whole. Projections based on the long-term average rate of increase therefore involve a future rate of increase considerably less than the rate of recent years. Such a lower rate of increase would, however, not be inconsistent with the expected trend toward fuller utilization of both new and recycled materials.

[83] Adjusted to a 1950 base, the projections of physical-structure materials input for 1975 are of the same general order of magnitude as those developed by the President's Materials Policy Commission.

TABLE 202.—*Input of physical-structure materials in 1952 with projections to 1975 and 2000*

Year	GNP	Total input	Increase over 1952	Input per million GNP dollars	Input per capita
	Billion dollars	*Billion units*	*Percent*	*Units*	*Units*
1952	350	5. 9	--------	169	37. 8
1975	630	8. 3	40	132	38. 6
1975	645	8. 5	43	132	37. 3
2000	1, 200	12. 2	105	102	44. 3
2000	1, 450	14. 7	148	101	40. 8

If industrial wood, i. e., all timber products except fuelwood, holds its 1952 relative position in the Nation's input of physical-structure materials, something on the order of these percentage increases would apparently be required.

Since consumption of fuelwood has been declining for a long time, projections of energy-material input have little relevance (fig. 109). The uses of this kind of fuel are limited to heating and cooking on farms, to fireplaces, and to production of heat and power in some wood-processing plants. It is doubtful that requirements for energy materials in general have any real bearing upon demand for fuelwood.

TIMBER PRODUCTS IN THE NATION'S ECONOMY

Timber occupies an important place in the Nation's economy. The best information available indicates that about 1 out of every 19 employed persons (5.4 percent) in 1952 obtained his living from activities connected with the growing, protection, harvesting, processing, transportation, distribution, and fabrication of timber products (table 203). Wages and salaries generated in 1952 by various timber-connected economic activities are estimated at about $11 billion and national income at about $15 billion,[84] or about one dollar out of every twenty of total national income

[84] In addition to wages and salaries of employees, includes corporate net income derived from timber-connected activities and net income to the proprietors of unincorporated enterprise. It does not include allowance for depreciation nor for the business taxes borne by these activities. Also it does not include the net income from sales of standing timber from public lands and from "other" private ownerships, or from the fabrication of timber products outside timber-connected industry: Activities such as boat building, building and repair of railroad cars, fabrication of wooden containers not done in box factories, and a large number of similar activities. Income not included in the estimates probably adds up to several hundred million dollars.

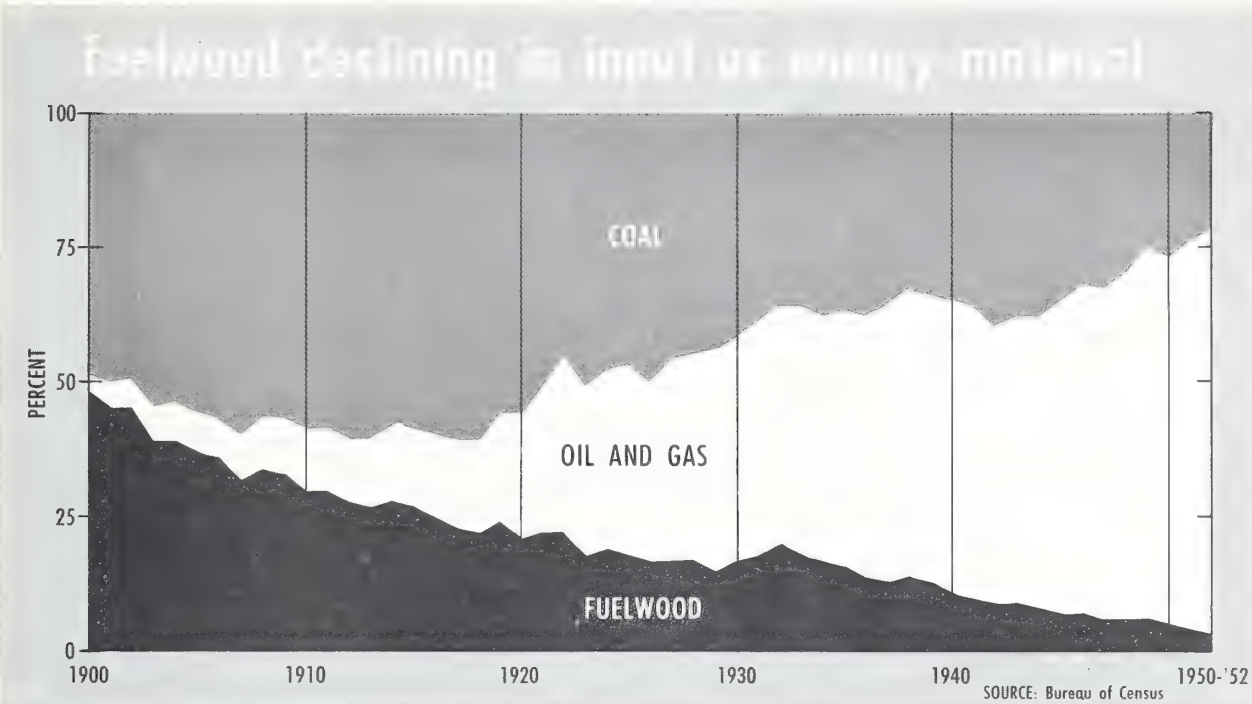


Figure 109

(table 204). These estimates are based partly on employment estimates and partly on Department of Commerce statistics of wage and salary payments and national income for the lines of activity under consideration. No exact data are available, but that part of the gross national product due to all timber-connected economic activity may have been of the order of $20 billion.

While these estimates are subject to considerable margins of error, the errors are not large enough to nullify the conclusions that the manpower employed in the growing and protection of timber is comparatively meager and that present expenditures on efforts to grow and protect timber (less than 2 percent) represent a comparatively small fraction of the total national income that springs from timber-connected economic activity. Yet the estimates also indicate that a significant part of the Nation's employment and income is generated by timber use and that much economic activity is dependent upon adequate supplies of timber.

Trends in the Input of Industrial Wood

Measured in terms of input units, industrial wood has comprised a sizable part of physical-structure materials consumption. In the early 1900's it represented close to 30 percent (table 205). By 1914 the wood sector had begun to shrink, and that shrinkage continued rather steadily until it reached 15 percent in 1931. But as economic recovery progressed through the later 1930's and 1940's, the wood sector expanded again to a considerable extent. In the period 1950–52, it represented more than 19 percent of total physical-structure materials input.[85] During the period 1940–52 as a whole, input of industrial wood more than kept pace with input of physical-structure materials in general (fig. 110).

In comparing trends in inputs of industrial wood and of all physical-structure materials (fig. 111), a significant feature is the contrast between the declining trend of industrial-wood input from 1914 to 1932 and the concurrent upward trend of total physical-materials input. Then, since the early 1930's, that contrast in the direction of the two trend lines was changed to a rather close similarity. In fact, input of industrial wood, since

[85] If the price base of the input units were to be shifted from the 1935–39 average to more recent price relationships, the trends in relationship of industrial-wood input to input of all the physical-structure materials would remain about the same. But since the price of industrial wood, lumber in particular, has increased much more than prices of other physical-structure materials, the input of industrial wood—weighted by recent values—would represent considerably more than 19 percent of total physical-structure materials.

TABLE 203.—*Estimates of employment connected with the timber resource in 1952*

Class of economic activity	Man-years of employment		
	Total	Timber-connected	
	Thousand	*Percent*	*Thousand*
All economic activity	[1] 63, 485	5. 4	3, 398
Timber-based industries:			
Forestry	65	100	65
Lumber and timber basic products	655	100	655
Pulp, paper, and allied products	504	100	504
Furniture and fixtures	563	55	[2] 310
Total	1, 787		1, 534
Timber-connected activity elsewhere:			
Farming, including farm construction	5, 731	5	[3] 300
Contract construction and maintenance, nonfarm	3, 622	20	[4] 700
Synthetic fiber manufacture, chiefly rayon	72	78	56
Textile mill products, including rayon	1, 199	15	180
Railroad transportation, freight	1, 244	13	158
Highway and water freight transportation	879	8	70
Wholesale and retail trade	11, 816	3	400
Total	24, 563		1, 864
All timber-connected activity listed above	26, 350		3, 398

[1] Not to be confused with labor force concepts previously discussed.
[2] Based partly on judgment because statistics for the industry do not completely separate wood furniture and fixtures from similar goods made of other materials.
[3] May be low.
[4] May be too high for some kinds of construction but low for residential construction.

Source: U. S. Department of Commerce, *National Income, 1954; Survey of Current Business*, July 1953; *Annual Survey of Manufactures*, 1952; *Census of Business*, 1948; and U. S. Department of Labor, Bureau of Labor Statistics, *Construction During Five Decades.*

the early 1930's, has averaged a slightly faster rate of increase than input of all physical-structure materials.

The chief reasons for the strengthened position of industrial-wood input relative to total input has been the rapid increase in consumption of pulpwood and veneer products (fig. 112). In the early 1900's lumber comprised more than 70 percent of industrial-wood input, pulpwood about 2 percent, veneer logs and bolts less than 1 percent, and

TABLE 204.—*Wages and salaries and national income from timber-connected economic activities, 1952*

Class of activity	Wages and salaries	National income
	Million dollars	*Million dollars*
All economic activity	195, 423	290, 959
Timber-based industry:		
Forestry services [1]	147	164
Lumber and timber basic products	1, 944	2, 479
Paper and allied products	2, 134	3, 144
Wood furniture and wood fixtures	1, 020	1, 213
Total	5, 245	7, 000
Timber-connected activity elsewhere in the economy:		
On farms, including construction and repair	600	898
Contract construction, nonfarm	2, 189	2, 845
Rayon fiber and other wood chemicals	219	286
Textile products from rayon fiber	563	681
Railroad transportation of timber products	756	934
Highway and water transportation of timber products	275	356
Wholesale and retail trade in timber products	988	1, 528
Total	5, 590	7, 528
All timber-connected activity listed above	10, 835	14, 528

[1] Adjusted upward to include wages, salaries, and national income from forestry services provided by public agencies.

Source: U. S. Department of Commerce, *National Income*, 1954; *Survey of Current Business*, July 1953; *Annual Survey of Manufactures*, 1952; *Census of Business*, 1948; and U. S. Department of Labor, Bureau of Labor Statistics, *Construction During Five Decades.*

minor industrial-wood products (poles, posts, piling, round mine timbers, hewn ties, etc.), about 25 percent. By 1952, the pattern had changed quite radically. Lumber comprised 62 percent of industrial-wood input, pulpwood 27 percent, veneer logs and bolts 4 percent, and minor products 7 percent (table 206).

PRODUCT DISTRIBUTION OF TIMBER CONSUMED IN 1952

The 1952 United States consumption of timber products of all kinds, measured as volume of roundwood removed from forests, amounted to about 12.3 billion cubic feet, excluding bark (table 207). Of that total, domestic forests supplied about 91 percent. The other 9 percent was received as net imports of lumber, pulpwood,

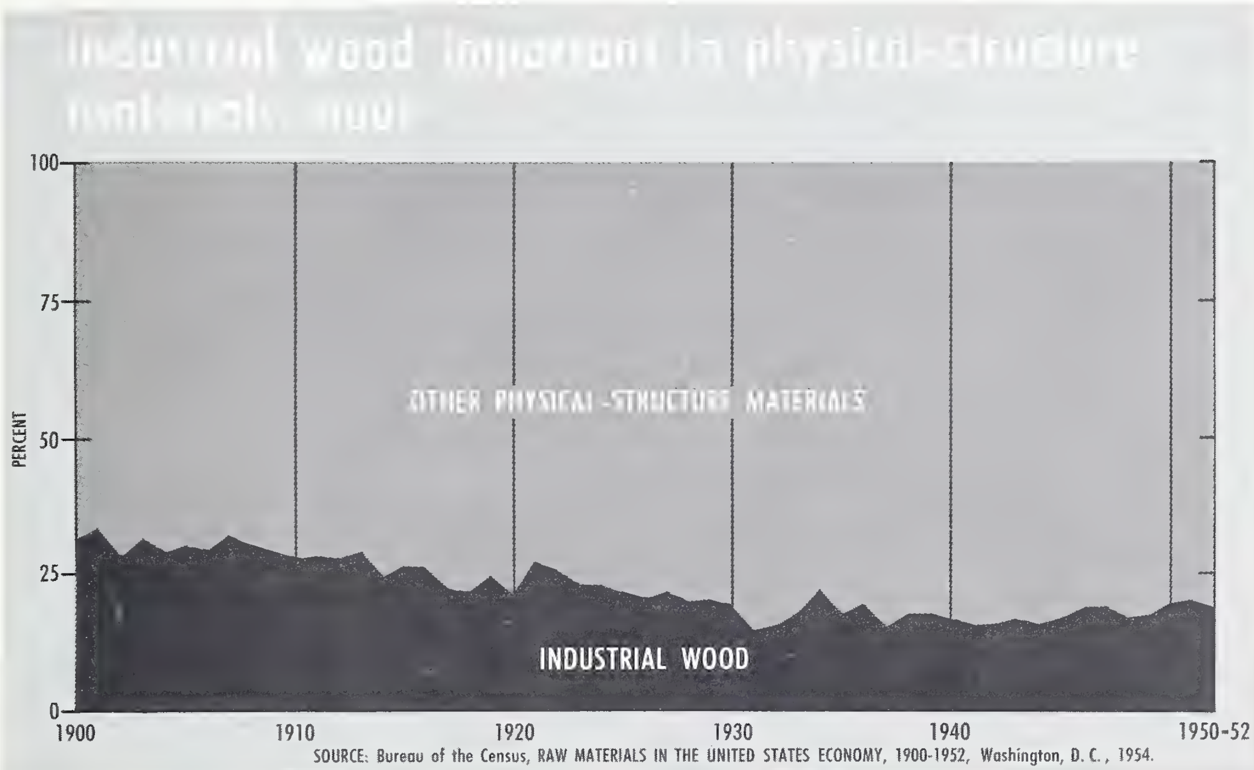


Figure 110

TABLE 205.—*Input of industrial wood as percent of total physical-structure materials input, 1900–1952*

Year	Percent	Year	Percent	Year	Percent
1900	31.5	1918	22.0	1936	19.2
1901	33.5	1919	24.6	1937	15.1
1902	28.6	1920	21.1	1938	17.7
1903	31.6	1921	27.1	1939	17.5
1904	29.1	1922	25.6	1940	16.4
1905	30.4	1923	23.1	1941	15.8
1906	29.8	1924	23.0	1942	15.9
1907	32.3	1925	21.8	1943	16.8
1908	30.6	1926	20.8	1944	15.9
1909	29.8	1927	21.9	1945	16.9
1910	28.4	1928	20.0	1946	18.8
1911	28.6	1929	20.3	1947	18.9
1912	28.2	1930	19.4	1948	17.0
1913	29.1	1931	14.9	1949	17.1
1914	24.9	1932	15.9	1950	19.6
1915	26.9	1933	18.1	1951	20.0
1916	26.1	1934	22.0	1952	18.5
1917	22.4	1935	17.7		

Source: Bureau of the Census, *Raw Materials in the United States Economy: 1900–1952*, p. 81. Washington, D. C. 1954.

woodpulp, paper, and various other items—chiefly from Canada. These net imports are included in the 12.3 billion cubic feet total in terms of their equivalent volume of roundwood.

The total volume of wood consumed in 1952 was sufficient to have provided every person with 78 cubic feet. Industrial wood comprised about 84 percent of the roundwood total and fuelwood accounted for about 16 percent (fig. 113).

THE BASIC ASSUMPTIONS

Discussion thus far has been concerned with prospective expansion of the Nation's economy and the general magnitude of raw material requirements likely to be associated with economic growth (table 208). The objective has been to provide a framework on which to base estimates of the Nation's future demand for timber products. These estimates rest on four major assumptions, the first two of which are held constant: (1) Peace but continued military preparedness, (2) economic prosperity reflected in high-level employment, (3) future population, and (4) the trend in prices of timber products relative to the trend in prices of competing nontimber products.

Figure 111.—Input of industrial wood and of all the physical-structure materials, 1900–1952.

Figure 112

From specific combinations of these major assumptions and from lesser assumptions, three different series of estimates, or projections, are developed: "medium projected demand," "upper projected demand," and "lower projected demand." Medium projected demand is the basic projection. The other two are modifications.

The *medium* projection rests on the assumptions that (a) the United States will have 215 million people by 1975, and 275 million by 2000 and (b) trends in future prices of timber products will be generally parallel to trends in prices of competing materials. The gross national product estimates associated with these population figures are $630 billion by 1975 and $1,200 billion by the year 2000 (in terms of 1953 prices).

The *upper* projection is based on the same price assumption, but the population assumed for 2000 is 360 million. The gross national product estimate associated with this population figure is $1,450 billion. No upper projection is made for 1975 because such a projection would not be appreciably higher than the medium projection. The assumption for a 1975 upper projection would be a population of 228 million and a gross national product of $645 billion—neither greatly different than the medium projection assumption of 215 million persons and $630 billion.

The assumptions underlying both the medium and the upper projections are that industrial wood will maintain its present relative position in the national economy of 1975 and 2000.

The *lower* projection of timber-product demand is based on the same population and gross national product assumption as used for the medium projection. However, the lower projection price assumption is that future prices of timber products will rise substantially faster than prices of substitute materials. This presumably would lead to extensive price-induced substitution of nonwood materials for timber products and a declining role for industrial wood in the national economy.

With regard to future prices of timber products the most clearcut assumption usable for purposes of demand projections is that the trend in the future price of the product under consideration will generally parallel the price trend of materials that may readily be substituted for it. Under such conditions no appreciable amount of *price-induced* substitution—either favorable or adverse—is expected. However, this is not to say there will be no change in the price of the product under consideration. All it implies is that such a change in price will not be greatly out of line with concurrent changes in the prices of substitute materials. The distinction just made is im-

TABLE 206.—*Estimated product composition of industrial-wood input,*[1] *1905–52*

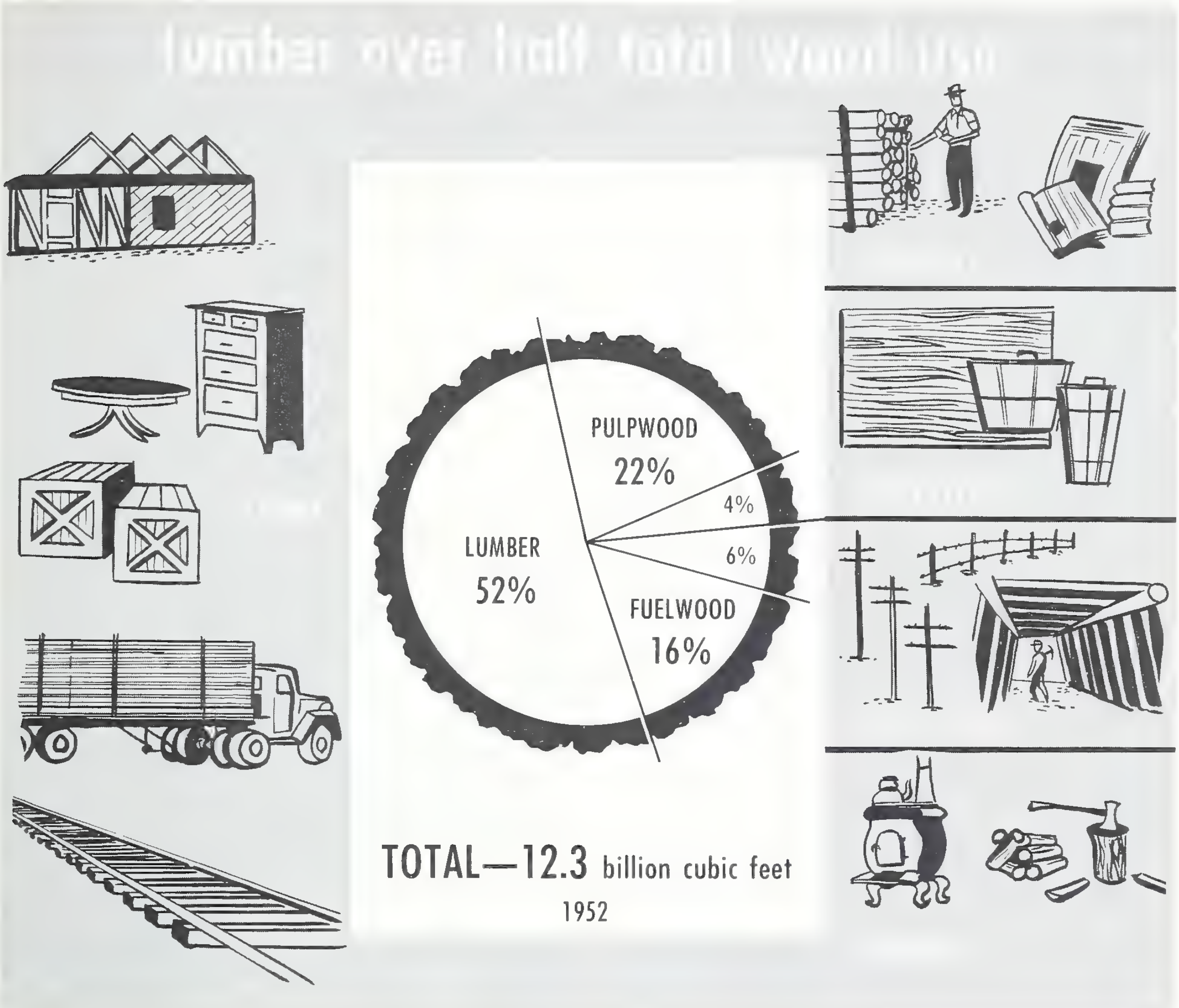
Year	Total industrial wood	Distribution				Year	Total industrial wood	Distribution			
		Lumber	Pulpwood	Veneer logs and bolts	Minor products			Lumber	Pulpwood	Veneer logs and bolts	Minor products
	Million cu. ft.	*Pct.*	*Pct.*	*Pct.*	*Pct.*		*Million cu. ft.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
1900	8, 782	73	2	(2)	25	1927	8, 221	68	12	2	18
1901	8, 891	73	2	(2)	25	1928	8, 509	69	12	2	17
1902	9, 030	73	2	(2)	25	1929	8, 095	65	14	2	19
1903	9, 054	72	3	(2)	25	1930	6, 754	65	16	2	17
1904	9, 010	72	3	(2)	25	1931	5, 131	58	19	2	21
1905	9, 134	72	3	1	24	1932	3, 853	51	22	3	24
1906	9, 640	73	3	1	23	1933	4, 566	56	22	3	19
1907	9, 825	71	4	1	24	1934	4, 901	57	21	3	19
1908	8, 912	71	4	1	24	1935	5, 920	61	19	2	18
1909	9, 534	71	4	1	24	1936	6, 540	61	20	2	17
1910	9, 484	71	4	1	24	1937	6, 835	59	22	3	16
1911	9, 083	71	5	1	23	1938	6, 124	60	20	3	17
1912	9, 421	71	5	1	23	1939	7, 087	62	20	3	15
1913	9, 310	70	5	1	24	1940	8, 007	67	18	3	12
1914	8, 711	69	6	1	24	1941	8, 477	67	20	3	10
1915	8, 452	68	6	1	25	1942	9, 790	70	18	3	9
1916	8, 936	69	6	1	24	1943	8, 816	69	18	3	10
1917	8, 320	67	7	1	25	1944	8, 257	65	21	3	11
1918	7, 694	65	8	1	26	1945	7, 754	62	24	3	11
1919	8, 009	67	7	1	25	1946	8, 443	62	25	3	10
1920	8, 199	66	8	1	25	1947	8, 770	60	27	3	10
1921	6, 945	64	8	1	27	1948	9, 360	61	27	3	9
1922	8, 023	68	9	1	22	1949	8, 706	62	26	4	8
1923	8, 923	71	9	1	19	1950	10, 145	63	26	4	7
1924	8, 598	70	10	1	19	1951	10, 110	60	28	4	8
1925	8, 787	71	10	1	18	1952	10, 266	62	27	4	7
1926	8, 677	70	11	2	17						

[1] Based on U. S. Forest Service estimates of roundwood (logs and bolts) consumption, including roundwood equivalent of net imports of lumber, woodpulp, paper, and veneer products.
[2] Less than 0.5 of 1 percent.

TABLE 207.—*Estimated consumption of timber products in the United States*

Product	Standard unit of measure	Volume in standard units			Volume in roundwood [1] products, 1952	
		1944	1950	1952		
		Million	*Million*	*Million*	*Million cu. ft.*	*Percent*
Saw logs (lumber, sawn ties, etc.) [2]	Bd.-ft. lumber tally	34, 600	40, 850	41, 462	6, 419	52. 3
Veneer logs and bolts	Bd.-ft. log scale	1, 533	2, 730	2, 647	451	3. 7
Pulpwood [3]	Standard cords	21	34	35	2, 697	22. 0
Cooperage logs and bolts	Bd.-ft. log scale	737	690	355	73	. 6
Piling	Linear feet	45	32	41	28	. 2
Poles	Pieces	4	7	6	88	. 7
Posts (round and split)	do	275	230	306	194	1. 6
Hewn ties	do	25	12	10	67	. 5
Mine timbers (round)	Cubic feet	150	100	81	81	. 6
Other industrial wood [4]	do	250	250	227	168	1. 4
All industrial wood	Cubic feet roundwood [1]	8, 257	10, 145	10, 266	10, 266	83. 6
Fuelwood	Standard cords	70	62	59	2, 008	16. 4
All timber products	Cubic feet roundwood [1]	11, 632	12, 272	12, 274	12, 274	100. 0

[1] The roundwood (logs and bolts) volume of pulpwood, of "other industrial wood" and of fuelwood includes only that cut directly from trees. Plant residues utilized for such products are part of the roundwood volume principally of saw logs and veneer logs and bolts.
[2] Estimates of apparent consumption based on estimated production, less exports, plus imports, and changes in lumber stocks.
[3] Includes net imports of pulpwood, also of woodpulp and finished paper expressed in terms of pulpwood.
[4] All other timber products, except fuelwood.



includes Coastal Alaska

Figure 113

portant because many of the factors that tend to raise the price of timber products also tend to force up the price of substitute materials. There is also the probability that an increase in price of any particular product exerts an upward pull on the price of its substitutes.

The medium projection of timber-product demand and the upper projection both rest on the assumption that price relationships will remain about as they have been in recent years. Price, of course, is not the only factor and often not the major factor that induces substitution. Both projections make substantial allowance for substitution of certain timber products for other timber products. It has been assumed, however, that these timber-for-timber substitutions will tend to balance out; and that industrial wood as a whole will continue to occupy about the same position in the Nation's raw-materials input that it has occupied in recent years.

The lower projection is based on the assumption that there will be a substantial rise in timber product prices relative to the prices of competing materials. The difficulty with this assumption is that it cannot be applied in any concise way because there are no devices by which to isolate the long-term impact of price change on quantity of timber product demand, and no standards by which the effects of long-term price changes can be measured.

Most of the work so far done in tracing the effects of price on quantity of a product demanded has been limited to short periods and to the consumer-goods market. This study is concerned

TABLE 208.—*Estimated economic growth of the United States, 1952–2000*

Item	Unit of measure	Estimate for 1952	Economic estimates basic to—		
			Medium and lower timber demand projections to 1975	Medium and lower timber demand projections to 2000	Upper timber demand projection to 2000
Population	Million people	157.0	215	275	360
Total labor force	do	66.4	85.0	110	133
Armed forces	do	3.4	3.5	4.0	4.0
Civilian labor force	do	63.0	81.5	106	129
Unemployed	do	1.7	3.5	4	5
Employed civilians	do	61.3	78.0	102	124
Workweek	Hours	40.2	35	30	30
Man-hour productivity	Dollars [1]	2.56	4.50	7.50	7.50
Gross national product	Billion dollars [1]	354.1	630	1,200	1,450
Disposable personal income	do	238	441	840	1,015
Input of physical-structure materials	Billion units	5.9	8.3	12.2	14.7

[1] 1953 dollars.

with long periods of time and with products that more generally classify as producer goods. Past influence of price change cannot actually be disentangled from the influence of nonprice factors such as technological change, effectiveness of advertising and sales promotion, standardization of product quality, and services rendered by producers to their customers. Analyses of the past long-term relationship between price change and quantity of a product consumed are therefore subject to considerable uncertainty, and any projection of past relationships into the future carries with it an assumption that marketing policy and organization on the supply side (in conjunction with price change) will continue to operate about as they have in the past. This implicit assumption conflicts with the concept that demand is dependent solely upon the number of consumers, consumers' purchasing power, consumers' preference, and relative price.

For the lower projections, judgment estimates were made of quantity of various products that might be demanded, provided that price of timber products rises substantially faster than price of nonwood materials. Further details concerning the lower projections appear later in the treatment of lumber, pulpwood, veneer logs and bolts, and the minor industrial-wood products.

FUTURE DEMAND FOR LUMBER

Lumber, with only a few exceptions over the past 30 years, has represented from 60 to 70 percent of all the industrial wood consumed annually in the United States. While the consumption of pulpwood and of veneer logs and bolts has been increasing very rapidly, those increases have been just about equivalent to the decreases in consumption of the minor industrial-wood products such as hewn ties, cooperage, mine timbers, and some others. Past experience thus points to the probability that lumber will continue to occupy the major sector of industrial-wood input—at least for the remainder of this century.

Projections of future demand for lumber involve two different procedures. The medium and upper projections are based on analyses of lumber consumption by end uses. The various end-use estimates thus determined are then added together to obtain each of the two projections. Such a procedure is possible because both projections rest on the assumption that there will be no change in the price relationships of timber products and competing materials.

The lower projection of future demand for lumber, on the other hand, is made differently. Because this projection is based on the assumption of substantial change in price relationships, the estimates of total demand are developed first, based on analysis of trends in lumber price and consumption. Allocation to end uses of lumber is then done on a judgment basis—using estimated 1952 consumption and the medium projections of end-use demand for guidance. Consequently these lower estimates are no more than rough approximations of end uses. Uniform percentage reduction of each medium projection of end-use demand appeared to be not entirely reasonable because demand in certain end uses is probably affected less by price than demand in other end uses.

In the following detailed analysis of future lumber demand, all of the end-use estimates are developed first, under the assumption pertaining to the medium and upper projections. To facilitate comparison, the allocations made under the lower projection are presented along with the medium and upper estimates.

Lumber for Use in Construction

About three-fourths of the lumber consumed in the United States in 1952 went into various types of construction. Residential construction, farm as well as nonfarm, absorbed an estimated 40 percent. There is no apparent reason to doubt that residential construction will continue to be the largest single use of lumber. The projections of demand for lumber in residential construction are derived from estimates of future requirements for housing.

Residential Construction May Reach Three Million Units Annually by 2000

The number of households requiring shelter at any time prior to 1975 can be estimated with reasonable confidence. The reason is that very few persons not already born will be old enough by 1975 to have set up households of their own.

For present purposes, it is necessary to consider only the population age 20 and older. All four series of Census population projections to 1975 contain the same figures for that segment of the population (table 209). Extending these Census Bureau population projections to 2000, according to the method previously discussed, 190 million persons will be age 20 or older 45 years hence, if population totals 275 million; 210 million if population reaches 360 million.

TABLE 209.—*Bureau of the Census projections of the population age 20 and older, 1955–75*

[In thousands]

Age group (years)	1955	Projections to— 1960	1965	1970	1975
20 to 24	10, 766	11, 276	13, 461	17, 301	19, 281
25 to 29	11, 744	10, 867	11, 355	13, 556	17, 422
30 to 34	12, 392	11, 805	10, 900	11, 390	13, 597
35 to 39	11, 600	12, 406	11, 791	10, 887	11, 376
40 to 44	11, 209	11, 552	12, 327	11, 715	10, 817
45 to 49	10, 091	11, 056	11, 369	12, 132	11, 530
50 to 54	8, 809	9, 800	10, 714	11, 018	11, 758
55 to 59	7, 839	8, 382	9, 307	10, 177	10, 466
60 to 64	6, 690	7, 248	7, 735	8, 591	9, 398
65 and over	14, 127	15, 800	17, 371	18, 879	20, 655
Total, all ages	105, 267	110, 192	116, 330	125, 646	136, 300

Note: Assuming that age-specific mortality rates will continue to decline as in the 1940's until 1955–60 and remain constant thereafter until 1975; and that net immigration will continue at about the same level as prevailed from the end of World War II to 1955.

Source: Bureau of the Census. *Revised Projections of the Population of the United States, by Age and Sex: 1955 to 1975.* Current Population Rpts. Ser. P–25, No. 123. October 1955.

The average number of persons age 20 and older per household has been decreasing quite steadily throughout the past 65 years, from 2.69 in 1890 to 2.20 in 1955 (fig. 114). The decrease since 1940 has been more rapid than previously. Part of this can be accounted for in the decline of the number of families living "doubled up" in one dwelling unit. A larger percentage of older persons now maintain independent households. The continuing extension of average span of life has also increased the percentage of older-couple households and of households maintained by a surviving spouse. That tends to reduce the average number of adults per household. These trends can be expected to continue, at least for a while.

Projections of the number of households in the United States population to 1975 (table 210) are based on the Census estimates of population age 20 and older and on the assumed continuance of a moderate downward trend in average number of persons age 20 and older per household to 1975 and a slight further decrease to 2000. After 1975, the number of households will be influenced strongly by the fertility rates of 1955–80.

The average annual net increase of households during specified periods 1950 through 2000 is projected as follows:

Period:	*Annual net increase in thousands*
1950–54	1, 017
1955–60	535
1961–65	760
1966–70	1, 020
1971–75	1, 200
1976–2000	1, 040 1, 440

The prospective slump in new household formation between the present and 1965 will be due chiefly to the low fertility rates of the 1930's. The upsurge that will occur after 1965 will be due to the higher fertility rates since 1940.

Projections of the Nation's future stock of housing must take into account, not only the prospective number of households to be sheltered, but also the normal margin of unoccupied housing. In the 1950 Census of Housing [86] this included the following categories:

	Thousand units	*As percent of occupied units*
Resident temporarily away	127	0. 3
Seasonal dwelling units, nonfarm and farm	1, 050	2. 5
Nonseasonal, not dilapidated, not for sale or rent	743	1. 7
Total unoccupied units not on the housing market	1, 920	4. 5
Nonseasonal, not dilapidated, for sale or rent	732	1. 7
Nonseasonal, dilapidated	505	1. 2
All unoccupied dwelling units	3, 157	7. 4

[86] Bulletin H–A1, p. 12.

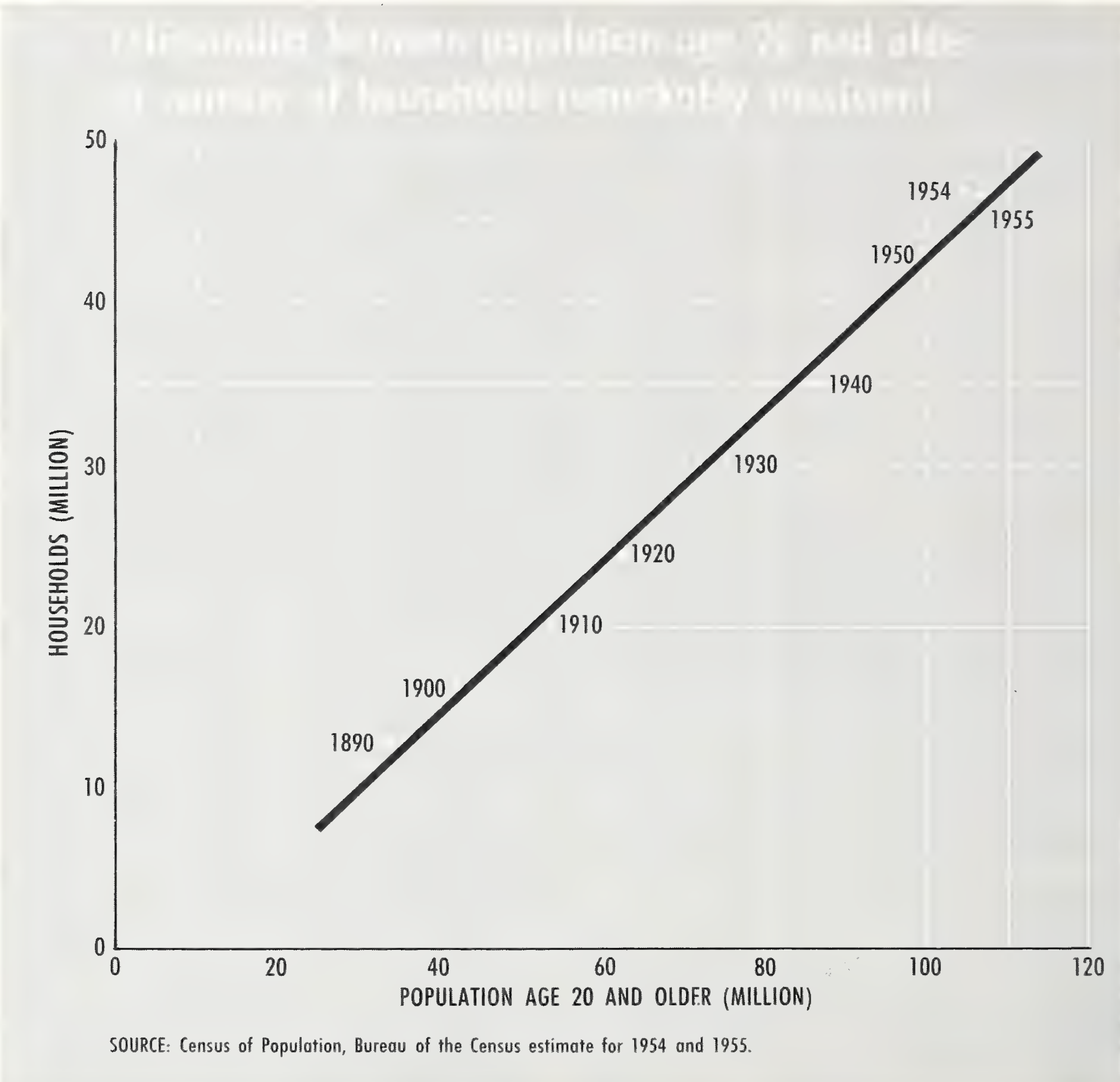


Figure 114

The item "nonseasonal, not dilapidated, for sale or rent" includes what may be called the "active vacancy." It was probably much lower than usual in 1950. The "nonseasonal, dilapidated" units include many on their way out of the Nation's housing inventory but not yet demolished or converted to nonresidential uses. In 1950, some 43 percent of the latter units were on farms, 36 percent were classified as rural nonfarm, and 21 percent as urban. Many were unoccupied as the result of migration from agricultural to industrial areas.

Looking ahead to 1975 and 2000, it seems reasonable to expect that a somewhat larger percentage of families will maintain seasonal summer or winter homes, and that active vacancy will increase considerably above the 1.7 percent that existed in the tight housing situation of 1950. Assuming there will be a dwelling unit for each household to live in, and that unoccupied units of all kinds will

TABLE 210.—*Population age 20 and older, number of households, and average number of persons age 20 and older per household*

Year	Population age 20 and older [1]	Number of households [2]	Average number of persons age 20 and older per household
	Thousand	*Thousand*	*Number*
1890	34, 148	12, 690	2. 69
1900	42, 314	15, 964	2. 65
1910	53, 410	20, 256	2. 64
1920	62, 668	24, 352	2. 57
1930	75, 116	29, 905	2. 51
1940	86, 364	34, 855	2. 48
1950	99, 598	43, 554	2. 29
1954	103, 991	46, 893	2. 22
1955	105, 267	47, 788	2. 20
1960	[3] 110, 192	[4] 50, 100	2. 20
1965	116, 330	53, 900	2. 16
1970	125, 646	59, 000	2. 13
1975	136, 300	65, 000	2. 10
2000	[5] 190, 000	91, 000	2. 08
	210, 000	101, 000	2. 08

[1] Data for 1890 through 1950 from *Census of Population;* estimate for 1954 by Bureau of the Census, Current Population Reports, Ser. P–20, No. 56, March 1955.

[2] Data for 1890 through 1950 from 1950 *Census of Housing,* Report H–A1, p. xxvii. Estimates for 1950, 1954, and 1955 by Bureau of the Census, Current Population Reports, Ser. P–20, No. 59, August 1955.

[3] Projections 1960–75 from Bureau of the Census, *Revised Projections of the Population of the United States, by Age and Sex: 1960 to 1975.* Current Population Rpts. Ser. P–25, No. 123, October 1955.

[4] Based on estimated trend in average number of persons age 20 and older per household, from foregoing data in last column.

[5] Assuming total population of 275 and 360 million. Extension of Census Bureau's 1960–75 projections.

not exceed 8.0 percent of the number occupied in 1975, or 8.5 percent in 2000, the Nation's stock of housing may increase about as follows:

	Average annual increase (thousand dwelling units)	*Housing inventory at end of period (thousand dwelling units)*
1950	-----	45, 983
1950–54	1, 160	50, 640
1955–60	577	54, 100
1961–65	820	58, 200
1966–70	1, 100	63, 700
1971–75	1, 300	70, 200
1976–2000	1, 150	99, 000
	1, 600	110, 000

For 2000, the lower figure is based on a total population of 275 million, the upper figure on 360 million.

The average annual net increase, of course, is simply the number of new dwelling units required to accommodate the net increase of households and to maintain a margin of unoccupied units only slightly larger than existed in 1950. Other factors to be taken into account are replacement of losses and of housing that becomes unusable.

Losses of housing by fire, flood, and windstorm have recently averaged about 40,000 dwelling units per year or about one-tenth of 1 percent of total stock.[87] Much has been done over the years to reduce fire hazards and to improve fire protection systems; further progress is to be expected. But on the other hand, the shift of population to suburbs and to open country puts a higher percentage of nonfarm dwellings beyond the reach of the more efficient fire protection systems, and outside the bounds of well-enforced fire-safety building codes. Flood protection is being improved, but little has yet been done to zone flood-plain areas against residential use or to remove existing residential structures from them. Increased pressure for residential building sites on flood-plain lands can be expected. Losses caused by hurricane and tornado are even more difficult to avoid.

On the whole, it appears unlikely that the rate of loss will change much. Assuming it stays somewhere near one-tenth of 1 percent of the housing stock, the average annual loss (and consequent replacement requirement) may be:

	Thousand dwelling units
1950–54	48
1955–60	54
1961–65	58
1966–70	64
1971–75	70
1976–2000	100
	110

The two estimates for 2000 are based on housing stocks of 99 million and 110 million dwelling units.

The replacement of obsolete and wornout housing, of housing demolished because of change in land use, and of housing abandoned in shifts of population is difficult to estimate. In 1953, some 5 million urban dwelling units apparently were in such poor condition that demolition was justified.[88] Spread over 10 years, this one job would call for replacement at the rate of 500,000 units annually. Meanwhile other urban housing would have become substandard. In addition, there is a sizable backlog of rural housing that does not meet minimum standards. Replacement of all presently wornout housing would push total annual replacement to 600,000 or 700,000 units over a 10-year period.

While the progress so far made toward removal of substandard housing is not great, there has been more progress than appears on the surface. The driving force is the migration of population.

[87] U. S. Housing and Home Finance Agency. *How Big Is the Housing Job?* Washington, D. C. 1951.

[88] President's Advisory Committee on Government Housing Policies and Programs, *Report to the President of the United States,* p. 111. Washington, D. C. 1953.

Census Bureau surveys show that about 1 out of every 5 households moves during the course of each year. About 6.5 percent move from one State to another or from one county to another. In areas that are losing population there is abandonment of the poorest housing, which soon deteriorates to unusable condition.

The Census of Housing indicates that during the decade 1940–50 some 2.0 to 2.5 million dwelling units were demolished or converted to other use, or became so deteriorated that they were no longer habitable.[89] That would be an average of 200,000 to 250,000 units per year. Because of the critical housing shortage that prevailed during the period (on account of the low level of residential construction during the 1930's, and the virtual stoppage of residential building during World War II) the disappearance of older housing was probably far less than would be expected under conditions of sustained high-level employment and no major wars. The stock of housing actually aged to a considerable extent. The percentage of all dwelling units in structures 30 or more years old increased from 41 percent to 46 percent and nearly one-third of the 1950 units were in structures built before 1910: [90]

Year built:	*Age (years)*	*Dwelling units (millions)*	*Dwelling units (percent)*
Prior to 1879	70 and over	2. 6	5. 7
1880–89	60–69	2. 0	4. 3
1890–99	50–59	3. 7	8. 0
1900–09	40–49	6. 3	13. 7
1910–19	30–39	6. 6	14. 3
1920–29	20–29	9. 2	20. 0
1930–39	10–19	6. 1	13. 3
1940–49	10 or less	9. 5	20. 7

Age of structure is of course not the only factor that leads to replacement of older housing. As standards of living rise, more people want modern homes. As their families grow, they also want bigger houses.

Insofar as can be judged from data available, replacement of dwelling units in the years 1952–55 has averaged not less than 568,000 annually (table 211). For the longer period 1950–55 it averaged not less than 437,000 per year.[91]

The various considerations presented above support the belief that in a national economy functioning at sustained high levels of employment, with continuing increase of per capita buying power and continuing government programs to improve housing and encourage home ownership, obsolescent and wornout housing will be replaced at a rate substantially above that of recent years. Average annual replacement in the future is estimated as follows:

	Thousand dwelling units
1954–60	550
1961–65	600
1966–70	625
1971–75	650
1976–2000	1, 250 1, 300

While the replacement estimate for 2000 appears large, the stock of housing in which replacements will be required will probably be more than twice that of 1950.

Adding the three separate estimates, for net addition to housing stock and for replacement of disaster losses and obsolescent housing, the following average annual requirements for new dwelling units are indicated:

	Thousand dwelling units
1954–60	1, 200
1961–65	1, 500
1966–70	1, 800
1971–75	2, 000
1976–2000	2, 500 3, 000

For the period 1954–60, the estimate is somewhat under the average number of new units built annually during 1950–55. Whether there will actually be a sag in residential construction in the years just ahead depends on how fast the present accumulation of substandard housing is replaced. But even though residential construction may not be maintained at 1950–55 levels during the next few years, there can be no doubt about the large demand that will develop beyond 1960.

[89] This inference is based on a State-by-State comparison of the reported net gain in number of dwelling units against the number of units in structures built in that decade. Where the 10-year net increase was less than number built, that difference was obviously due to disappearance from the stock of housing that existed in 1940. The net disappearance, thus indicated, in 31 of the States amounted to 1,136,000 dwelling units. The total number of units that disappeared from housing stock in those States was certainly larger, because part of the net gain in number of units undoubtedly resulted from subdivision of older large units into two or more dwelling units. This type of conversion was stimulated by the housing shortage during the war years and immediately thereafter.

In 17 other States, the net gain in number of dwelling units exceeded the number of new units built by 619,000. In those States the gain by conversions exceeded the number that disappeared by that margin. But still a considerable disappearance of housing must have occurred even in those States. Housing does wear out no matter where it is. Changes in land use to make way for commercial and industrial development occur all the time, and demolition of residential structures is frequently involved.

[90] *1950 Census of Housing*, Ser. HC–9, No. 5, p. 1. Units built prior to 1920 are allocated to earlier periods according to distribution reported in the 1940 Census of Housing.

[91] These figures are obtained by subtracting the Census Bureau's estimates of net increase of households from the estimated total number of dwelling units built. The figures are probably on the low side because official data on number of dwelling units built do not include those in structures classified as temporary.

TABLE 211.—*Apparent minimum annual net replacement of dwelling units in the United States, 1950–55*

Year	Estimated total number of new dwelling units built [1]	Net increase of households	Apparent net replacement of dwelling units
	Thousand	*Thousand*	*Thousand*
1950	1, 564	1, 372	192
1951	1, 263	1, 102	161
1952	1, 301	848	453
1953	1, 261	830	431
1954	1, 369	559	810
1955	1, 472	895	577
1952–55 average	1, 351	783	568
1950–55 average	1, 371	934	437

[1] Bureau of Labor Statistics estimates of new permanent nonfarm dwelling units started plus the estimated number of new farm dwellings built. Estimates of farm dwellings built are based on Census of Housing data for the period 1945–49, allocated to years by use of the Department of Agriculture estimates of farm construction expenditures in 1947–49 dollars. Extrapolation from 1949 is based on the construction expenditure estimates in 1947–49 dollars. By this method, the estimates of number of farm dwellings built are as follows:

Year:	*Thousand*	Year:	*Thousand*
1945	32	1950	168
1946	120	1951	172
1947	159	1952	174
1948	158	1953	157
1949	157	1954	149
		1955	143

The total for the period 1945–49, 626 million, is a reasonably reliable Census of Housing estimate.

Source: U. S. Housing and Home Finance Agency. *Housing in the Economy, 1955*, tables A–1 and A–64, pp. 16 and 64. Washington, D. C. 1956. *Census of Housing, 1950*, Bul. H–A1, p. 3. Expenditures for farm construction in 1947–49 dollars, *Construction Review*, February 1955 and August 1956; Department of Commerce, *National Income*, pp. 216–217, 1954 Ed.

Type and Size of Dwelling Unit Are Changing

The use of lumber in residential construction is influenced in part by changes in the type and size of living quarters that people want. The trend has been away from the two-family and multi-family type of structure toward the single-family house. Fifty years ago, about one-third of all private nonfarm dwelling units being built were in two-family and multi-family structures. In 1955, less than one-tenth of the number built were of those types: [92]

Year:	*Single-family (percent)*	*Two-family (percent)*	*Multi-family (percent)*
1900	65	16	19
1905	66	13	21
1910	65	15	20
1915	61	17	22
1920	82	10	8
1925	61	17	22
1930	69	9	22
1935	84	4	12
1940	85	5	10
1945	89	4	7
1950	85	3	12
1955	91	2	7

While the bulk of public housing built since the 1930's has been multi-family, farm housing has been almost entirely single-family. Hence, the upward trend in single-family structures since 1930 is somewhat greater than the private nonfarm figures indicate. Housing has tended to move out of the field of heavy construction, where concrete and steel have strong competitive advantages, toward the field of light construction where lumber and other timber products have advantages.

The average floor space per dwelling unit decreased by something like 25 percent between 1920 and 1950 but, since 1950, there apparently has been some increase (table 212). Also, ceiling heights have been getting lower, reducing the internal cubic-foot volume to a somewhat greater extent than indicated by floor space measurements alone. Stanford Research Institute has estimated the 1920–53 trend in floor space, ceiling height, and cubic-foot volume in terms of an index based on 1920 average dimension: [93]

	Floor space	*Ceiling height*	*Cubic volume*
1920	100	100	100
1930	86	99	86
1940	82	96	79
1950	75	92	69
1953	76	90	68

It is rather unlikely that there will be a further decrease in the average size of dwelling unit. More probable is some increase to accommodate the larger number of children that the majority of families are now having. This factor will, of course, be offset to some extent by the concurrent increase of older couples and single persons who maintain separate homes.

Changes in type and size of average dwelling unit have been accompanied by changes in architectural style. The single-story house has gained in popularity over the two-story model, and this trend has increased the area of roof surface required to cover a given square footage of floor space. There has been a marked reduction in the

[92] U. S. Housing and Home Finance Agency. *Housing in the Economy 1955*, table A–2, p. 17. Washington, D. C. 1956.

[93] Stanford Research Institute. *America's Demand for Wood, 1929–1975*, p. 30. Weyerhaeuser Timber Co., Tacoma, Wash. 1954.

TABLE 212.—*Estimates of average square feet of floor space per dwelling unit, specified years*

Year	Average floor space per unit		
	All types [1]	Single-family houses only [2]	All nonfarm housing [3]
	Sq. ft.	*Sq. ft.*	*Sq. ft.*
1920	1,310		
1930	1,130		
1940	1,080	1,177	
1950	980	983	
1953	1,000		
1954			1,086
1955			1,115

[1] Includes farm as well as nonfarm housing. Stanford Research Institute. *America's Demand for Wood, 1929–1975*, p. 32. Weyerhaeuser Timber Co., Tacoma, Wash. 1954.

[2] Housing and Home Finance Agency. *The Materials Use Survey*, p. 4. Government Printing Office, Washington, D. C. 1953.

[3] Bureau of Labor Statistics. *Characteristics of New Housing—First Quarter, 1954*, and *Characteristics of New Housing—First Quarter, 1955* (mimeographed releases) December 30, 1954, and November 15, 1955. Weighted average for single-family and multi-family housing.

slope of roofs but an increase in the overhang at ends and sides. Insofar as rafters and roof joists are concerned, lumber has had no serious competition. But economies in rafter material have been accomplished through the use of truss design. With regard to roof sheathing, lumber has been displaced to a large extent by plywood and hardboard. Some further displacement is anticipated.

With regard to exterior-wall structure, lumber holds a prominent position. About 82 percent of the single-family units built in the first quarter of 1954 were wood-frame houses and another 3 percent were modifications of the wood-frame type (table 213). These wood-frame structures were normally distributed throughout the full price range of new, nonfarm, single houses, with moderate bias in favor of the lower-price brackets. The distribution of brick and brick-faced masonry houses was biased in favor of the higher-price brackets. Concrete-block and other masonry construction has a foothold in the lower-price field, but so far it does not have a strong hold in any price bracket of single-family housing.

The heavier inroads made by nonwood materials against lumber have been in the exterior covering of wood-frame houses (table 214). During the first quarter of 1954, wood-frame houses faced with brick were more likely to sell for $12,000 and up; those faced with asbestos shingles were more likely to sell for less than $12,000. Houses faced with wood were normally distributed throughout the full range of selling prices, with moderate bias in favor of the lower-price field. Thus, it seems that asbestos shingles compete strongly with wood siding in low-priced, single-family housing, and brick, or brick and wood in combination, are strong competitors in the higher-priced field. Therefore, the preference for brick must be due to factors other than the price of installed material.

To reduce the labor costs of installing lumber in housing, large lumber sheathing panels made up of edge-glued boards are beginning to enter the market. And paper plastic overlays applied to low-grade lumber siding—to hide defects, improve paintability, and provide more dimensional sta-

TABLE 213.—*New nonfarm single-family dwelling units started in first quarter of 1954, as percent of total units started, by type of exterior-wall construction and selling-price class*

Selling-price class (dollars)	Total all types	Wood-frame and other nonmasonry construction			Masonry construction			Type unknown
		Total	Wood frame [1]	Other including some prefabricated [1]	Total	Brick and brick facing	Concrete block and other	
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Under 7,000	10.6	9.7	8.5	1.2	0.9	0.2	0.7	(2)
7,000–9,999	14.8	12.6	12.2	.4	2.2	1.2	1.0	(2)
10,000–11,999	20.0	17.4	17.1	.3	2.4	1.6	.8	0.2
12,000–14,999	24.0	21.7	21.4	.3	2.1	1.7	.4	.2
15,000–19,999	16.5	12.7	12.5	.2	3.6	3.1	.5	.2
20,000 and over	9.7	7.4	7.1	.3	2.1	1.7	.4	.2
Price unknown	4.4	3.0	2.9	.1	.3	.1	.2	1.1
Total	100.0	84.5	81.7	2.8	13.6	9.6	4.0	1.9

[1] Prefabricated units of wall-panel construction are in both of these classes.

[2] Less than 0.05 percent.

Source: U. S. Bureau of Labor Statistics. *Characteristics of New Housing—First Quarter, 1954.* Washington, D. C. December 1954. (Mimeographed.)

TABLE 214.—*New wood-frame nonfarm dwelling units started in first quarter of 1954, as percent of total units started, by kind of exterior wall-facing material and selling-price class*

Selling-price class (dollars)	Total, all facing materials	Facing material: Wood	Wood and brick	Brick	Asbestos shingle	Other
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Under 7,000	10.4	5.8	(1)	0.1	4.3	0.2
7,000–9,999	14.9	7.3	0.1	1.5	4.5	1.5
10,000–11,999	20.9	8.7	.6	4.0	3.5	4.1
12,000–14,999	26.3	6.7	2.1	8.8	2.6	6.1
15,000–19,999	15.1	5.0	1.7	5.0	1.6	1.8
20,000 and over	8.9	3.4	1.0	3.5	.1	.9
Price unknown	3.5	1.5	.1	1.1	.4	.4
Total	100.0	38.4	5.6	24.0	17.0	15.0

[1] Less than 0.05 percent.

Source: U. S. Bureau of Labor Statistics. *Characteristics of New Housing—First Quarter, 1954.* Washington, D. C. December 1954. (Mimeographed.)

bility—are beginning to appear. Further development along these lines is to be expected.

Other developments are taking place in prefabrication; about 6.3 percent of the nonfarm dwelling units built in 1954 were prefabricated houses.[94] For example, several of the systems of prefabricated housing utilize "stressed-skin" panels [95] for exterior walls, for inside partitions, and for other components. While the volume of lumber used per house for stressed-skin panel walls is less than for conventional studding, the important feature is that prefabricated housing, so far, has been made almost wholly of timber products.

Another architectural innovation which has reduced lumber use in some new housing is the concrete slab. Instead of wall or pillar foundations, about 16 percent of the single-family houses started in the first quarter of 1955 were set on concrete slabs.[96] In this type of construction, girders, main-floor joists, and heavy sills are eliminated. Floors are usually of asphalt tile laid directly on the slab, eliminating both wood flooring and subflooring. Whether this trend toward use of the concrete slab will continue is difficult to judge. It certainly has the advantage of lower cost of installation. But it has some critical disadvantages. Unless heating elements are imbedded in the slab, the floor is apt to be uncomfortably cold. If heating conduits are imbedded in the slab, any repairs or changes which may later be required are troublesome and costly. Furthermore, most persons have a strong preference for hardwood flooring in living rooms and bedrooms. It may, of course, be feasible to provide such floors on concrete slab by use of wood flooring specially treated to give high dimensional stability.

In some of the housing now being erected on basement foundations, steel beams are being substituted for wooden girders to provide more rigidity and eliminate the need for supporting posts in the basement. It is not improbable that this trend will continue.

While wood floor joists and ceiling joists have no serious competition, there has been extensive substitution of plywood and hardboard for lumber. These sheet materials have no special advantage so far as price is concerned, but they can be laid with much less labor. The same advantage would attach to glued lumber panels mentioned above. If the latter come into use as subflooring materials, lumber might hold its position or even recapture some lost ground in the subflooring field.

Sheet materials of various kinds are being used extensively for exterior wall sheathing. Saving of labor at construction site is the chief advantage. Plywood provides an excellent base for exterior coverings of all kinds, but the various building fiberboards have some disadvantages. If lumber siding is used as covering, the joints can occur only at studs because the fiberboards have limited nail-holding power. If wooden or asbestos shingles are used for covering, wood strips usually must be provided, or the builder must use "shingle backer construction" with special nails to attach the shingles.

[94] Estimates of the Prefabricated Home Manufacturers Institute.

[95] Such panels are composed of a light frame of dimension lumber to which a cover of plywood or hardboard is glued. The cover, or skin, thus becomes integral with the frame and carries a large part of the stress that may be put upon it.

[96] U. S. Department of Labor, Bureau of Labor Statistics. *Characteristics of New Housing, First Quarter 1955.* November 15, 1955. (Mimeographed.)

For covering interior walls and ceilings, the trend has been away from wood-lath-and-plaster to gypsum board and other sheet materials. Displacement of wood lath is almost complete. There is, however, a counter trend of some importance in the use of lumber panels, particularly panels with knots or other "character marks" which give an interesting decorative effect. Lumber-panel interior finish has become especially popular for basement recreation rooms, dens, and even in living rooms and dining rooms. It is a favorite material for use in the "do-it-yourself" projects that so many homeowners have undertaken.

Other displacement of lumber has occurred in coverings for kitchen and bathroom floors, framing and sash material for windows (especially basement windows), framing material for screens and screen doors, and a number of other items. The old panel door is rapidly giving way to the flush door, which contains less lumber. Covered porches are not often seen in new housing.

When these various trends are taken into account, it appears more than likely that average lumber use per house will continue to decrease somewhat. That decrease would, however, be offset in part by the expected moderate increase in the average size of dwelling unit.

Average Lumber Use Per Dwelling Unit Is Decreasing

Estimates of the average amount of lumber used per dwelling unit, built at various times in the past, have been made by several agencies, based on sampling surveys. The most recent survey, conducted by Stanford Research Institute in cooperation with the National Association of Home Builders,[97] shows that average use per unit (for all kinds of housing, including that on farms) decreased from 18,900 board-feet in 1920 to 10,500 board-feet in 1953 (table 215). That decrease, of course, reflects not only the substitution of other materials for lumber, but also the reduction in average size of unit, and the notable shift away from the multi-family to the single-family house.

An approximation of the trend in lumber use per dwelling unit, disregarding change in size, can be derived from the Institute's figures by averaging the indexes of average square feet of floor space and of average cubic volume per unit, described above, and applying this resulting average size-of-unit index to the 1953 estimates in table 215, as follows:

	Size-of-unit index (1900=100)	*Average lumber use per unit at constant 1953 size (board-feet)*
1920	100.0	13,608
1930	86.0	12,894
1940	80.5	12,432
1950	72.0	11,697
1953	72.0	10,500

According to this method of estimation, the displacement of lumber by other materials during the period 1920–53 amounted to 3,100 board-feet per unit for dwelling units at constant 1953 average size, or 23 percent. These estimates of lumber use, of course, are averages for all types of new residential construction—multi-family housing as well as single-family houses, farm as well as nonfarm. The displacement of lumber in the average single-family house has doubtless been somewhat greater than the average for all types. A part of that displacement from single-family houses has been offset by the sizable shift away from multi-family types of construction.

The Stanford estimates for 1950 are apparently somewhat higher than those obtained for the same year by the U. S. Housing and Home Finance Agency.[98] The latter came from an inventory of materials used in construction of a 5,000-unit sample of single-family houses distributed throughout the country. Farm and multi-family housing were not sampled. Neither did the inventory include the normal single-family house accessories, such as detached garages, porches, and the like. Millwork was included, but the quantity of mill-

TABLE 215.—*Stanford Research Institute estimates of lumber use per dwelling unit by house components, specified years, 1920–53*

[In board-feet per unit]

Component	1920	1930	1940	1950	1953
Foundations	1,700	1,350	1,300	1,100	900
Floors	4,300	3,700	3,300	2,550	1,950
Ceilings	975	825	800	750	800
Roofs	2,800	2,250	2,550	2,600	2,400
Exterior walls	2,500	2,350	2,100	1,750	1,600
Interior walls	2,950	2,300	1,700	1,500	1,500
Millwork	2,600	1,950	1,400	1,050	950
Accessories [1]	1,075	675	750	400	400
Total	18,900	15,400	13,900	11,700	10,500

[1] Includes detached garages and miscellaneous other accessories.

Source: Stanford Research Institute. *America's Demand for Wood, 1929–1975*, p. 35. Weyerhaeuser Timber Co., Tacoma, Wash. 1954.

[97] Stanford Research Institute. *America's Demand for Wood, 1929–1975*, p. 31. Weyerhaeuser Timber Co., Tacoma, Wash. 1954.

[98] U. S. Housing and Home Finance Agency. *The Materials Use Survey.* Washington, D. C. 1953.

work lumber was not separately estimated. With allowances for millwork and with the addition of normal accessories (according to the Stanford estimates) average lumber use per single-family house built in 1950, according to the HHFA study, totals about 10,800 board-feet:

	Average lumber use (board-feet)
Dimension lumber	5, 184
Board lumber	2, 581
Siding lumber	612
Finish wood flooring	940
Millwork	1, 050
Accessories	400
Total	10, 767

Direct comparison of the Stanford and HHFA estimates for 1950 is not entirely valid because the latter was limited not only to single-family dwellings, but also to those approved for financing under Federal Housing Administration mortgage insurance. Since houses financed with FHA insurance tend to be slightly smaller than those built with conventional financing, the HHFA included in its estimate an upward adjustment in the average area of living space of 5 percent; however, there is no way of knowing whether that adjustment was adequate. Furthermore, sampling errors of the two surveys are not given.

Taking the HHFA estimate for single-family dwellings at face value, allowing somewhat more lumber per farm unit, and much less for multi-family structures, and including some 44,800 two-family units in the single-family, nonfarm category, the weighted average for all types of housing in 1950 may have been about 10,100 board-feet:

Type:	*Thousand units*	*Board-feet per unit*
Nonfarm, single-family	1, 198. 9	10, 767
Farm	168. 0	11, 500
Multi-family structures	197. 1	5, 000
Weighted average		10, 119

This estimate is somewhat lower than the Stanford estimate of 11,700 board-feet of lumber per dwelling unit built in 1950. But, to be conservative, it is chosen here as the basis for estimating that the average lumber content per unit for all housing built in 1952 (2 years later) was 10,000 board-feet.

Projections of Demand for Lumber in New Residential Construction

The average lumber content of dwelling units built 20 and 45 years hence can be estimated only on the basis of explicit assumption and of judgment. Trends in substitution of other timber products for lumber must have due consideration. There is also a definite trend toward dwelling units of larger average size.

Average lumber use per dwelling unit—assuming a continuation of 1952 price relationships—may decrease 10 percent to 9,000 board-feet by 1975 and 12 percent to 8,800 board-feet by 2000 (table 216). The smaller decrease for the latter part of the period is based on the idea that substitution for lumber may become technologically more difficult as time goes on, and that producers of lumber can be expected to intensify their efforts to hold markets in residential construction. If trends in substitution continue, the use per dwelling unit of other timber products (such as plywood, hardboard, and insulating board) will just about double by 1975 and increase still further by 2000. Nonwood material use will increase moderately along with increases in the average size of dwelling unit. On the other hand, if the real price of lumber increases substantially, average lumber use per dwelling unit may decline to about 7,700 board-feet in 1975 and about 6,200 board-feet in 2000.

Projected demand for lumber in new residential construction is derived by multiplying the average annual requirements for new delling units (previously developed according to population assumed for 1975 and 2000) by the corresponding lumber content per unit (table 217). Increases over 1952 range from 18 percent under the lower projection for 1975 to 69 and 100 percent under the medium and upper projections for 2000.

	Million board-feet
Consumption in 1952	13, 010
Projections to 1975:	
Lower	15, 300
Medium	18, 000
Projections to 2000:	
Lower	15, 400
Medium	22, 000
Upper	26, 000

TABLE 216.—*Estimated average use per dwelling unit of lumber, and of other structure materials as lumber-volume equivalent, 1952; and projections to 1975 and 2000* [1]

Year	Lumber	Other wood products	Nonwood materials	All materials
	Board-feet	*Board-feet equivalent*	*Board-feet equivalent*	*Board-feet or equivalent*
1952	10, 000	1, 130	9, 170	20, 300
1960	9, 700	1, 500	9, 400	20, 600
1965	9, 500	1, 600	9, 600	20, 700
1970	9, 250	1, 800	9, 750	20, 800
1975	9, 000	2, 000	9, 900	20, 900
2000	8, 800	2, 200	10, 300	21, 300

[1] Assuming price relationships between lumber and other materials remain approximately unchanged.

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TABLE 217.—*Estimated quantity of lumber and other structural materials used in new residential construction, 1952; median projections to 1975 and 2000*

Year	Dwelling units [1]	Lumber	Other timber products	Non-wood materials	All materials
	Thousand	*Million board-feet*	*Million board-feet equivalent*	*Million board-feet equivalent*	*Million board-feet or equivalent*
1952	1, 301	13, 010	1, 470	11, 930	26, 410
1960	1, 200	11, 640	1, 800	11, 280	24, 720
1965	1, 500	14, 250	2, 400	14, 400	31, 050
1970	1, 800	16, 650	3, 240	17, 550	37, 440
1975	2, 000	18, 000	4, 000	19, 800	41, 800
2000	2, 500	22, 000	5, 500	25, 750	53, 250

[1] Farm and nonfarm.

Nonresidential Construction Closely Related to Economic Growth

Another large field of lumber use is construction of commercial and industrial buildings, public utilities, highways, military installations, sewer and water facilities, structures for conservation and development of natural resources, and similar items.[99] The main problem of analyzing trends and relationships pertaining to nonresidential construction (in the aggregate, or by types) is in measuring the physical volume of such construction. Buildings come in various sizes and shapes, electric power lines are measured in miles, flood-control dams are measured in size of the dam structure and in storage capacity of the reservoir. The only common unit of measure available for such a heterogeneous collection of facilities is the dollar value of construction put in place during given periods, statistically adjusted to exclude year-to-year changes in construction costs.

Department of Commerce estimates of volume of construction are used, but it has been necessary to convert them from a 1947–49 to a 1953 cost basis, type by type, using the relationship of 1953 dollar volume at 1953 costs to 1953 dollar volume at 1947–49 costs (table 218). The dollar volume of construction at costs of any specified year, of course, is intended to be an indication of physical volume put in place, not of dollar expenditures.[100]

The most striking feature of this historical record of nonresidential construction activity—and one that raises problems in projecting future requirements—is the drastic fluctuations experienced over the period 1915–55 (fig. 115). Despite these fluctuations, due in large measure to depression and war, there can be little doubt that long-term economic growth entails a fairly definite quantity of nonresidential construction. Goods cannot be manufactured without factory buildings, or distributed without the facilities of commerce. Increase of population and of disposable personal income raises requirements for schools, hospitals, churches, theaters, public-utility service, highways, airports, and all the other accouterments of modern living.

Nonresidential construction in terms of volume put in place annually per million dollars of annual gross national product reveals more consistency (table 219). At 1953 prices, the 1915–55 average relationship has been 60.9 thousand dollars of construction per million dollars of gross national product.

A projection of 55.5 thousand dollars of nonresidential construction per million dollars of gross national product by 1975 and 2000 would appear to be reasonable (table 220). Allocation of these two projections to "private" and to "public" and to major types, made partly on the basis of long-term and recent averages and partly on judgment, allows for more highway building and for the probability that construction of public school buildings will be stepped up considerably. The allocation to military facilities is comparatively small, in accordance with the assumption that major wars will be avoided.

Based on these rates, the projected volume of new nonresidential construction, in terms of 1953 costs, by 1975 may amount to about $35 billion (table 221). By the year 2000, it may amount to about $67 billion if population is at the 275 million level, and to about $80 billion if population is at the 360 million level.

Lumber Plays Facilitating Role

In most types of nonresidential construction, lumber is used chiefly in what might be called a facilitating role. Stanford Research Institute, in a 1953 survey of a thousand large construction

[99] Because of special information available, future demand for crossties and for other lumber used by railroads will be considered separately later. Demand for lumber in nonresidential construction on farms is also deferred until later.

[100] Dollar volume estimates of construction, whether in year-to-year costs or in the costs of a specified period, do not include costs of land nor speculative profits. They do include all costs of materials and of service facilities installed, of architectural and engineering services, of labor, and of overhead and profit on construction operations. If the relationship of material to nonmaterial costs changes during a period of time, constant-dollar volume may not be as accurate an index of physical volume as could be desired. But in the absence of the data necessary for refinement of existing dollar-volume estimates, they must be taken as they are.

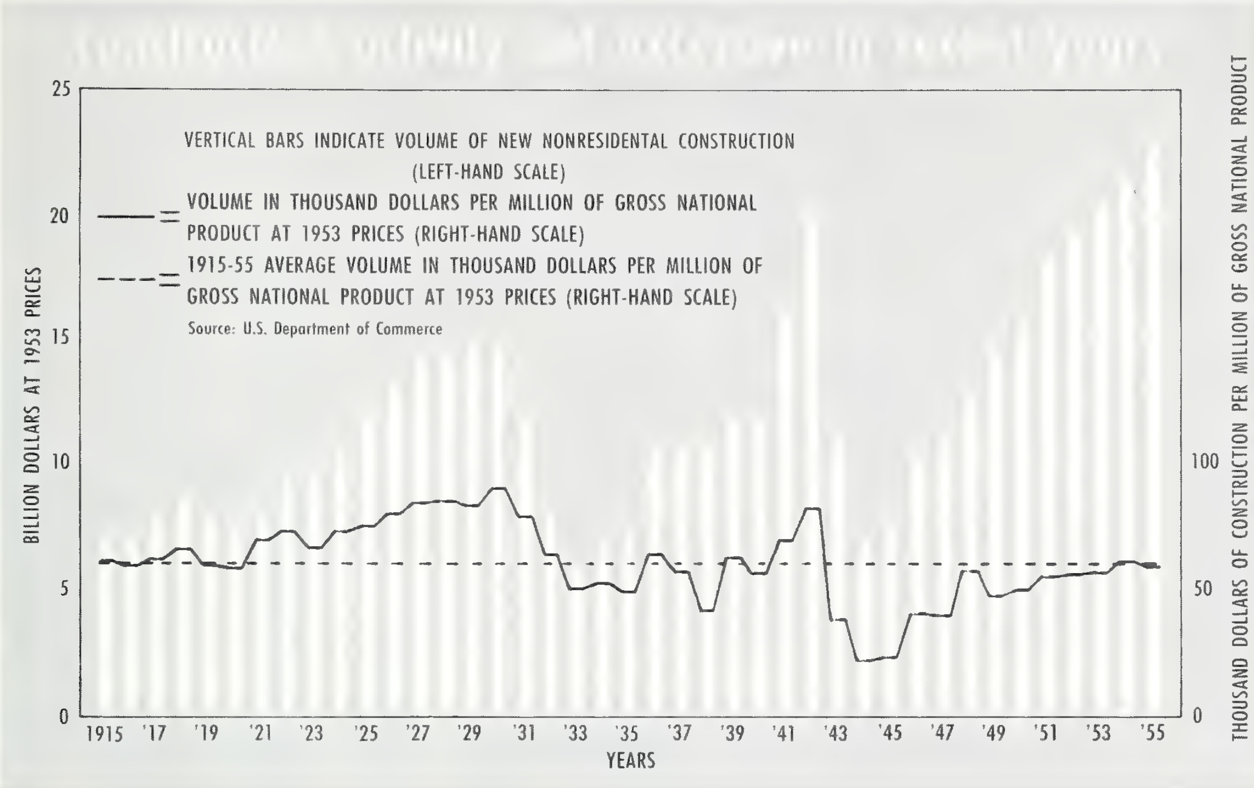

Figure 115.—Volume of new nonresidential construction (excluding railroad and farm) put in place annually.

contractors, found that concrete forms are the major item:[101]

	Percent
Concrete forms	58
Framing and trim	20
Scaffolding	10
Bracing, shoring, decking	9
Temporary buildings, skids and other uses	3
Total	100

Plywood, hardboard, and other sheet materials have displaced a large volume of lumber in concrete forms, but these serve only as facing material. Lumber is still the dominant form of material for studs and bracing, and it probably will not be displaced to any large extent. Concrete and lumber are often competitive, but they are also complementary. Usually it is not practicable to erect concrete structures without using a considerable volume of lumber, though much of the lumber can be used several times.

It would, however, be a mistake to relegate the future use of lumber in nonresidential construction entirely to facilitating roles. The modern trend in buildings of many kinds (for light manufacturing industry, for warehouses, suburban stores, schools and gymnasiums, garages, and churches) is away from the multiple-story structure toward the single-story structure spread over a larger area of ground. In low-type buildings of light construction, the possibilities for economical use of structural lumber are more favorable than in tall buildings where heavy construction is a prime requirement.

The problem of obtaining large unobstructed interior space under a wood-supported roof has been solved by development of the glued laminated wooden arch. That type of construction is becoming increasingly popular for churches and gymnasiums where pleasing interior effects with no ceilings are desirable. Where ceilings are desired, the wood truss with metal timber connectors provides an excellent roof structure. For buildings in which high relative humidity is maintained (textile factories, for example) preservative-treated wood has several advantages. Moisture does not condense on surfaces as in the case of mineral materials, and there is no problem of corrosion. Large-scale development of air conditioning has provided a new use for lumber as structural material for water-cooling towers. In general, the prospect for continued use of a large volume of

[101] Stanford Research Institute. *America's Demand for Wood, 1929–1975*, p. 42. Weyerhaeuser Timber Co., Tacoma, Wash., 1954.

TABLE 218.—*Estimates of volume of new nonresidential construction (excluding railroad and farm) put in place annually, 1915–55*

[Expressed in millions of dollars at 1953 prices]

Year	Private and public total	Private total	Private					
			Buildings				Utilities	All other private
			Total	Industrial	Commercial	Other		
1915	6, 856	3, 924	2, 378	(1)	(1)	(1)	1, 208	338
1916	7, 130	4, 662	3, 113	(1)	(1)	(1)	1, 276	273
1917	7, 824	4, 168	2, 844	(1)	(1)	(1)	1, 136	188
1918	8, 657	3, 149	2, 220	(1)	(1)	(1)	769	160
1919	7, 968	3, 814	2, 744	(1)	(1)	(1)	916	154
1920	7, 406	5, 293	3, 961	2, 192	1, 279	490	1, 173	159
1921	7, 863	4, 867	3, 764	1, 567	1, 423	774	920	183
1922	9, 402	5, 819	4, 067	1, 333	1, 647	1, 087	1, 507	245
1923	9, 519	6, 391	4, 199	1, 339	1, 747	1, 113	1, 943	249
1924	10, 463	6, 782	4, 222	1, 184	1, 802	1, 236	2, 282	278
1925	11, 990	7, 678	5, 264	1, 316	2, 333	1, 615	2, 139	275
1926	13, 289	8, 872	6, 385	1, 864	2, 715	1, 806	2, 212	275
1927	14, 162	9, 197	6, 503	1, 831	2, 829	1, 843	2, 387	307
1928	14, 337	9, 104	6, 597	2, 109	2, 759	1, 729	2, 240	267
1929	14, 899	9, 598	6, 896	2, 567	2, 707	1, 622	2, 454	248
1930	14, 519	8, 098	5, 446	1, 612	2, 167	1, 667	2, 443	209
1931	11, 846	5, 222	3, 380	761	1, 244	1, 375	1, 683	159
1932	8, 285	2, 793	1, 749	271	715	763	925	119
1933	6, 138	2, 063	1, 464	629	450	385	466	133
1934	7, 046	2, 080	1, 470	597	544	329	515	95
1935	7, 371	2, 231	1, 525	487	671	367	632	74
1936	10, 912	3, 187	2, 205	787	885	533	921	61
1937	10, 464	4, 156	2, 917	1, 280	1, 036	601	1, 166	73
1938	10, 531	3, 290	2, 092	617	757	718	1, 128	70
1939	11, 819	3, 489	2, 161	694	776	691	1, 261	67
1940	11, 662	4, 158	2, 710	1, 134	914	662	1, 371	77
1941	16, 501	5, 140	3, 594	1, 868	1, 005	721	1, 476	70
1942	22, 047	2, 619	1, 379	713	342	324	1, 201	39
1943	11, 399	1, 200	473	303	69	101	713	14
1944	7, 145	1, 710	734	426	115	193	953	23
1945	7, 403	3, 131	2, 004	1, 231	403	370	1, 088	39
1946	10, 432	7, 436	5, 470	2, 631	1, 911	928	1, 880	86
1947	11, 212	7, 082	4, 126	2, 241	1, 102	783	2, 858	98
1948	13, 145	7, 765	4, 235	1, 650	1, 445	1, 140	3, 447	83
1949	14, 707	7, 630	3, 811	1, 177	1, 184	1, 450	3, 722	97
1950	15, 761	8, 058	4, 346	1, 238	1, 464	1, 644	3, 580	132
1951	18, 538	9, 143	5, 490	2, 208	1, 475	1, 807	3, 583	70
1952	19, 419	8, 980	5, 152	2, 355	1, 180	1, 617	3, 738	90
1953	20, 612	9, 774	5, 680	2, 229	1, 791	1, 660	3, 974	120
1954	21, 745	10, 177	6, 184	2, 085	2, 138	1, 961	3, 876	117
1955	22, 875	11, 315	7, 274	2, 404	2, 797	2, 073	3, 894	147

Footnote at end of table.

TABLE 218.—*Estimates of volume of new nonresidential construction (excluding railroad and farm) put in place annually, 1915–55*—Continued

[Expressed in millions of dollars at 1953 prices]

Year	Public total	Public					
		Buildings	Military facilities	Highways	Sewer and water	Conservation and development	All other public
1915	2, 932	1, 242	64	728	530	181	187
1916	2, 468	1, 031	71	715	379	112	160
1917	3, 656	778	1, 772	633	270	81	122
1918	5, 508	649	3, 947	484	253	78	97
1919	4, 154	622	2, 408	635	306	96	87
1920	2, 113	580	280	747	300	108	98
1921	2, 996	1, 036	106	1, 173	438	129	114
1922	3, 583	1, 390	58	1, 321	545	130	139
1923	3, 128	1, 241	33	1, 090	478	153	133
1924	3, 681	1, 289	19	1, 393	620	187	173
1925	4, 312	1, 526	18	1, 605	673	177	313
1926	4, 417	1, 606	24	1, 647	691	148	301
1927	4, 965	1, 588	26	1, 913	753	152	533
1928	5, 233	1, 700	34	2, 158	726	174	441
1929	5, 301	1, 756	44	2, 192	604	275	430
1930	6, 421	1, 907	71	2, 824	836	335	448
1931	6, 624	1, 988	109	2, 818	700	405	604
1932	5, 492	1, 548	108	2, 504	462	444	426
1933	4, 075	871	106	1, 737	266	888	207
1934	4, 966	1, 230	127	1, 813	411	1, 147	238
1935	5, 140	1, 137	101	1, 605	434	1, 559	304
1936	7, 725	2, 325	77	2, 384	760	1, 447	732
1937	6, 308	1, 561	91	2, 288	643	1, 221	504
1938	7, 241	1, 888	155	2, 762	708	1, 127	601
1939	8, 330	2, 726	313	2, 747	761	1, 163	620
1940	7, 504	1, 625	936	2, 670	689	1, 077	507
1941	11, 361	3, 851	3, 662	1, 927	489	992	440
1942	19, 428	7, 525	9, 533	1, 032	324	736	278
1943	10, 199	3, 939	4, 535	572	211	565	377
1944	5, 435	2, 798	1, 540	511	152	313	121
1945	4, 272	1, 879	1, 260	583	179	242	129
1946	2, 996	609	290	1, 190	316	392	199
1947	4, 130	793	257	1, 698	491	551	340
1948	5, 380	1, 527	180	1, 853	674	790	356
1949	7, 077	2, 449	158	2, 359	760	974	377
1950	7, 703	2, 753	202	2, 624	765	1, 021	338
1951	9, 393	3, 754	932	2, 604	849	937	317
1952	10, 439	4, 265	1, 413	2, 759	829	901	272
1953	10, 838	4, 346	1, 307	3, 160	883	830	312
1954	11, 568	4, 607	1, 031	3, 960	939	675	356
1955	11, 560	4, 057	1, 266	4, 286	998	548	405

[1] Not separable from total.

Source: U. S. Department of Commerce and U. S. Department of Labor. *Construction Volume and Costs, 1915–1954*, Statistical Supplement to *Construction Review*, Vol. I., Washington, D. C. 1956; and *Construction Review* Issues of January and February 1956. (Values converted from 1947–49 prices to 1953 prices.)

TABLE 219.—*Volume of new nonresidential construction put in place annually per million dollars of gross national product, 1915–55*

[Thousand dollars of construction per million dollars of GNP, both at 1953 prices]

Year	Private and public total	Private						
		Total	Buildings	Industrial	Commercial	Other	Utilities	All other
1915	62.1	35.5	21.5	(1)	(1)	(1)	10.9	3.1
1916	60.0	39.3	26.2	(1)	(1)	(1)	10.8	2.3
1917	62.6	33.3	22.7	(1)	(1)	(1)	9.1	1.5
1918	65.7	23.9	16.9	(1)	(1)	(1)	5.8	1.2
1919	60.6	29.1	20.9	(1)	(1)	(1)	7.0	1.2
1920	58.1	41.4	31.0	17.2	10.0	3.8	9.2	1.2
1921	70.6	43.7	33.8	14.1	12.8	6.9	8.3	1.6
1922	72.9	45.1	31.5	10.3	12.8	8.4	11.7	1.9
1923	65.9	44.4	29.3	9.6	12.0	7.7	13.4	1.7
1924	72.3	46.9	29.2	8.2	12.5	8.5	15.8	1.9
1925	75.5	48.4	33.2	8.3	14.7	10.2	13.5	1.7
1926	80.1	53.5	38.5	11.2	16.4	10.9	13.3	1.7
1927	84.2	54.6	38.6	10.9	16.8	10.9	14.2	1.8
1928	85.0	54.0	39.1	12.5	16.4	10.2	13.3	1.6
1929	83.6	53.9	38.7	14.4	15.2	9.1	13.8	1.4
1930	90.4	50.4	33.9	10.0	13.5	10.4	15.2	1.3
1931	78.7	34.8	22.5	5.1	8.3	9.1	11.2	1.1
1932	64.7	21.8	13.7	2.1	5.6	6.0	7.2	.9
1933	49.9	16.7	11.8	5.1	3.6	3.1	3.8	1.1
1934	52.0	15.3	10.8	4.4	4.0	2.4	3.8	.7
1935	48.7	14.7	10.0	3.2	4.4	2.4	4.2	.5
1936	64.3	18.7	12.9	4.6	5.2	3.1	5.4	.4
1937	57.3	22.8	16.0	7.0	5.7	3.3	6.4	.4
1938	60.8	19.0	12.1	3.6	4.4	4.1	6.5	.4
1939	63.1	18.6	11.5	3.7	4.1	3.7	6.7	.4
1940	57.3	20.4	13.3	5.6	4.5	3.2	6.7	.4
1941	70.1	21.9	15.3	7.9	4.3	3.1	6.3	.3
1942	82.8	9.8	5.2	2.7	1.3	1.2	4.5	.1
1943	38.8	4.0	1.5	1.0	.2	.3	2.4	.05
1944	22.5	5.4	2.3	1.3	.4	.6	3.0	.1
1945	23.7	10.0	6.4	3.9	1.3	1.2	3.5	.1
1946	37.5	26.8	19.7	9.5	6.9	3.3	6.8	.3
1947	40.5	25.6	14.9	8.1	4.0	2.8	10.3	.4
1948	45.3	26.8	14.6	5.7	5.0	3.9	11.9	.3
1949	51.1	26.5	13.2	4.1	4.1	5.0	13.0	.3
1950	49.8	25.5	13.7	3.9	4.6	5.2	11.4	.4
1951	55.0	27.2	16.4	6.6	4.4	5.4	10.6	.2
1952	55.6	25.7	14.7	6.7	3.4	4.6	10.7	.3
1953	56.5	26.7	15.5	6.1	4.9	4.5	10.9	.3
1954	61.0	28.6	17.4	5.9	6.0	5.5	10.9	.3
1955	60.0	29.6	19.0	6.3	7.3	5.4	10.2	.4
1915–55 average	60.9	29.8	19.7	7.0	7.3	5.3	9.1	.9
1949–55 average	55.6	27.1	15.7	5.7	5.0	5.1	11.1	.3

[1] Not separable from total.

TABLE 219.—*Volume of new nonresidential construction put in place annually per million dollars of gross national product, 1915–55*—Continued

[Thousand dollars of construction per million dollars of GNP, both at 1953 prices]

Year	Public						
	Total	Buildings	Military	Highways	Sewer and water	Conservation and development	All other
1915	26.6	11.3	0.6	6.6	4.8	1.6	1.7
1916	20.7	8.7	.6	6.0	3.2	.9	1.3
1917	29.3	6.2	14.2	5.1	2.2	.6	1.0
1918	41.8	4.9	30.0	3.7	1.9	.6	.7
1919	31.5	4.7	18.3	4.8	2.3	.7	.7
1920	16.7	4.6	2.2	5.9	2.4	.8	.8
1921	26.9	9.3	1.0	10.5	3.9	1.2	1.0
1922	27.8	10.8	.5	10.2	4.2	1.0	1.1
1923	21.5	8.5	.2	7.5	3.3	1.1	.9
1924	25.4	8.9	.1	9.6	4.3	1.3	1.2
1925	27.1	9.6	.1	10.1	4.2	1.1	2.0
1926	26.6	9.7	.1	9.9	4.2	.9	1.8
1927	29.6	9.4	.2	11.4	4.5	.9	3.2
1928	31.0	10.1	.2	12.8	4.3	1.0	2.6
1929	29.7	9.9	.2	12.3	3.4	1.5	2.4
1930	40.0	11.9	.4	17.6	5.2	2.1	2.8
1931	43.9	13.2	.7	18.7	4.6	2.7	4.0
1932	42.9	12.1	.8	19.6	3.6	3.5	3.3
1933	33.2	7.1	.9	14.1	2.2	7.2	1.7
1934	36.7	9.1	.9	13.4	3.0	8.5	1.8
1935	34.0	7.5	.7	10.6	2.9	10.3	2.0
1936	45.6	13.7	.5	14.1	4.5	8.5	4.3
1937	34.5	8.5	.5	12.5	3.5	6.7	2.8
1938	41.8	10.9	.9	15.9	4.1	6.5	3.5
1939	44.5	14.5	1.7	14.7	4.1	6.2	3.3
1940	36.9	8.0	4.6	13.1	3.4	5.3	2.5
1941	48.2	16.3	15.5	8.2	2.1	4.2	1.9
1942	73.0	28.3	35.8	3.9	1.2	2.8	1.0
1943	34.4	13.3	15.3	1.9	.7	1.9	1.3
1944	17.1	8.8	4.8	1.6	.5	1.0	.4
1945	13.7	6.0	4.0	1.9	.6	.8	.4
1946	10.7	2.2	1.0	4.3	1.1	1.4	.7
1947	14.9	2.9	.9	6.1	1.8	2.0	1.2
1948	18.5	5.3	.6	6.4	2.3	2.7	1.2
1949	24.6	8.5	.6	8.2	2.6	3.4	1.3
1950	24.3	8.7	.6	8.3	2.4	3.2	1.1
1951	27.8	11.1	2.8	7.7	2.5	2.8	.9
1952	29.9	12.2	4.0	7.9	2.4	2.6	.8
1953	29.8	11.9	3.6	8.7	2.4	2.3	.9
1954	32.4	12.9	2.9	11.1	2.6	1.9	1.0
1955	30.4	10.7	3.3	11.3	2.6	1.4	1.1
1915–55 average	31.1	9.8	4.3	9.5	3.0	2.9	1.7
1949–55 average	28.5	10.9	2.5	9.0	2.5	2.5	1.0

TABLE 220.—*Average annual volume of new nonresidential construction (excluding railroad and farm) put in place per million dollars of gross national product during specified periods; and projection to 1975 and 2000*

[At 1953 prices] [1]

Class of construction	Thousand dollars of construction per million dollars of GNP			
	1915–55 average	1949–55 average	1955	Projection—1975 and 2000
Private, nonresidential:				
Industrial buildings	[2] 7.0	5.7	6.3	5.7
Commercial buildings	[2] 7.3	5.0	7.3	5.1
Other buildings	[2] 5.3	5.1	5.4	4.9
Utilities, excluding railroad	9.1	11.1	10.2	10.1
Others, excluding farm	.9	.3	.4	.3
Total	29.8	27.1	29.6	26.0
Public, nonresidential:				
Buildings	9.8	10.9	10.7	10.4
Military facilities	4.3	2.5	3.3	1.6
Highways	9.5	9.0	11.3	11.3
Sewer and water	3.0	2.5	2.6	2.5
Conservation and development	2.9	2.5	1.4	2.7
All other	1.7	1.0	1.1	1.0
Total	31.1	28.5	30.4	29.5
Private and public total	60.9	55.6	60.0	55.5

[1] Volume of construction and gross national product both in 1953 dollars.

[2] Average for 1920–55. Estimates for 1915–19 not available.

lumber in nonresidential construction is quite encouraging.

Estimates of the volume of lumber used in the various types of nonresidential construction have been made from time to time. The latest estimates of this kind by any government agency are those made by the Department of Commerce for 1949. Relating these estimates to the corresponding estimates of the dollar volume of construction put in place during 1949, in terms of 1953 prices, it is possible to calculate the number of board-feet of lumber used per dollar of construction (table 222). Substantially higher lumber-use-per-dollar estimates were produced by a 1953 survey by Stanford Research Institute.[102] One possible explanation of that difference is that lumber was in more plentiful supply in 1953 and may therefore have been used more generously. It is also possible that the Department of Commerce could have underestimated lumber consumption in nonresidential construction in 1949, or that the Institute overestimated in 1953. In order to be on the conservative side, it has seemed advisable to rely upon the factors derived from the estimates of the Department of Commerce.

[102] Publication cited, p. 43.

Projections of Demand for Lumber in New Nonresidential Construction

Multiplying the dollar volume of construction put in place during 1952 by factors derived from the Department of Commerce estimates indicates that some 5.4 billion board-feet of lumber may have been used for new nonresidential construction in 1952 (table 223).

Looking forward to 1975 and 2000, with past technological trends in mind, it appears probable that there will be some further net substitution of other materials for lumber in nonresidential construction. The medium and upper projections assume no appreciable change in the relationship of prices of lumber to prices of competing materials. Net substitution to be taken into account is that which would be due only to technological and other nonprice factors. On that basis, the overall net substitution would probably not exceed 15 percent by 1975 and 20 percent by 2000. The smaller decrease in the 1975–2000 period is based on the idea that the earlier phases of substitution will be pretty well exhausted by 1975.

The corresponding lower projections are based on the assumption of a substantial rise in real price of lumber. They are derived from the

TABLE 221.—*Volume of new nonresidential construction (except railroad and farm) put in place, 1955; projections to 1975 and 2000*

[At 1953 prices]

Class of construction	1955 actual[1]	Projections to— 1975, GNP at $630 billion	2000: GNP at $1,200 billion	2000: GNP at $1,450 billion
	Million dollars	*Million dollars*	*Million dollars*	*Million dollars*
Private:				
Industrial buildings	2, 404	3, 600	7, 400	8, 800
Commercial buildings	2, 797	3, 200	6, 300	7, 500
Other buildings	2, 073	3, 100	6, 100	7, 400
Utilities	3, 894	6, 300	12, 100	14, 400
All other private	147	200	300	300
Total private	11, 315	16, 400	32, 200	38, 400
Public:				
Buildings	4, 057	6, 600	12, 800	15, 300
Military facilities	1, 266	1, 000	1, 800	2, 100
Highways	4, 286	7, 100	14, 000	16, 800
Sewer and water	998	1, 600	2, 700	3, 200
Conservation and development	548	1, 700	2, 700	3, 200
All other public	405	600	800	1, 000
Total public	11, 560	18, 600	34, 800	41, 600
Private and public total	22, 875	35, 000	67, 000	80, 000

[1] U. S. Department of Commerce and U. S. Department of Labor. *Construction Review.* February 1956. (Values converted from 1947–49 prices to 1953 prices.)

medium projection by allowing for price-induced substitution amounting to 20 percent in 1975 and 40 percent in 2000:

	Million board-feet
Consumption in 1952	5, 400
Projections to 1975:	
Lower	5, 900
Medium	7, 400
Projections to 2000:	
Lower	8, 000
Medium	13, 400
Upper	16, 000

Maintenance and Repair Construction Requires Substantial Quantities of Lumber

Normal maintenance and repair of residential and nonresidential structures call for substantial quantities of lumber. In the discussion to follow, maintenance and repair construction includes (a) alterations and additions to residential structures,[103] (b) maintenance and repair of residential structures, and (c) nonresidential maintenance and repair, excluding railroad and farm.

TABLE 222.—*Department of Commerce estimates of lumber consumed in new nonresidential construction (excluding railroad and farm), 1949*

Class of construction	Lumber consumed [1]	Volume of construction in 1953 dollars [2]	Lumber per dollar
	Million board-feet	*Million dollars*	*Board-foot*
Private, nonresidential:			
Industrial buildings	327	1, 177	0. 278
Commercial buildings	450	1, 184	. 380
Other buildings	[3] 547	1, 450	. 377
Utilities, excluding railroad	839	3, 722	. 225
All other, excluding farm	2	97	. 021
Total	2, 165	7, 630	
Public, nonresidential:			
Buildings	674	2, 449	. 275
Military facilities	117	158	. 741
Highways	436	2, 359	[4] . 185
Sewer and water	152	760	. 200
Conservation and development	194	974	. 199
All other	57	377	. 151
Total	1, 630	7, 077	
Private and public total	3, 795	14, 707	

[1] U. S. Department of Commerce. *Construction and Construction Materials*, p. 9. August 1950.
[2] U. S. Department of Commerce and U. S. Department of Labor. *Construction Volume and Costs, 1915–1954*, Statistical Supplement to *Construction Review*, Vol. I. 1956. (Values converted from 1947–49 prices to 1953 prices.)
[3] Excluding 1,976 million board-feet for railroads. (Commerce estimate apparently did not include crossties nor lumber for cars.)
[4] A subsequent estimate by the Department of Commerce of lumber used in highway construction in 1955 indicates a factor of about 0.090 board-foot per dollar (*Construction Review*, September 1956, p. 6). This lower estimate has been used in projections.

Alterations and Additions to Residential Structures Related to Number of Households

This class of activity includes rearrangements of interior space by structural changes such as the installation of new partitions or shifting of original partitions, modernization of kitchens and

[103] Alterations and additions are commonly classified as new construction, but it is more convenient to consider such activity here along with maintenance and repair rather than elsewhere.

TABLE 223.—*Estimated volume of lumber consumed in new nonresidential construction (excluding railroad and farm) in 1952; medium and upper projection of demand to 1975 and 2000*

[Million board-feet]

Class of construction	1952 consumption	1975 projections with GNP at $630 billion	2000 projections with GNP at $1,200 billion	2000 projections with GNP at $1,450 billion
Private, nonresidential:				
Industrial buildings	655	1, 001	2, 049	2, 483
Commercial buildings	448	1, 216	2, 376	2, 885
Other buildings	610	1, 169	2, 315	2, 821
Utilities, excluding railroad	841	1, 418	2, 713	3, 266
All other, excluding farm	2	2	7	7
Total	2, 556	4, 808	9, 460	11, 462
Public, nonresidential:				
Buildings	1, 173	1, 815	3, 432	4, 269
Military facilities	1, 047	741	1, 324	1, 572
Highways	248	639	1, 266	1, 528
Sewer and water	166	320	536	648
Conservation and development	179	338	534	644
All other	41	91	118	152
Total	2, 854	3, 944	7, 310	8, 813
Private and public total	5, 410	8, 752	16, 770	20, 275
Reduction for technological substitution	------	1, 313	3, 354	4, 055
Projected demand	------	7, 439	13, 416	16, 220

TABLE 224.—*Estimated volume of alterations and additions to residential structures and of residential maintenance and repair, 1915–55*

[Expenditures at 1953 prices] [1]

Year	Alterations and additions	Maintenance and repair	Year	Alterations and additions	Maintenance and repair
	Million dollars	*Million dollars*		*Million dollars*	*Million dollars*
1915	636	2, 691	1936	858	3, 430
1916	620	2, 615	1937	833	3, 326
1917	456	2, 380	1938	745	2, 995
1918	336	2, 055	1939	794	3, 184
1919	342	1, 887	1940	803	3, 348
1920	358	1, 460	1941	833	3, 351
1921	471	1, 888	1942	474	2, 941
1922	554	2, 208	1943	322	2, 815
1923	519	2, 195	1944	407	2, 735
1924	576	2, 404	1945	588	2, 903
1925	633	2, 605	1946	898	4, 710
1926	677	2, 754	1947	956	5, 701
1927	736	3, 003	1948	1, 069	5, 780
1928	797	3, 172	1949	980	5, 924
1929	823	3, 288	1950	1, 012	5, 408
1930	759	2, 993	1951	976	5, 469
1931	473	2, 778	1952	1, 063	5, 637
1932	334	2, 538	1953	1, 108	5, 519
1933	462	2, 529	1954	1, 138	5, 939
1934	587	2, 701	1955	1, 246	(2)
1935	751	3, 072			

[1] Derived from Department of Commerce estimates of annual expenditure by use of E. H. Boeckh and Associates' construction-cost index for new residences.
[2] Not available.

Source: U. S. Department of Commerce and U. S. Department of Labor. *Construction Volume and Costs 1915–54*, Statistical Supplement to *Construction Review*. Washington, D. C. 1956; *Construction Review*, January 1956.

bathrooms, conversion of unfinished basements and unfinished attics to living space, installation of additional windows and entrances, or the addition of a room or rooms to the exterior of the structure.

With the recent trend toward larger families, the increase of owner-occupied housing, and the enthusiasm for do-it-yourself projects, there is reason to expect that residential alterations and additions will tend to keep pace with the increase in the Nation's stock of housing. For a while, at least, the amount of such work being done may increase even faster than the stock of housing. Complaints are often heard that much of the housing built during the past 20 years does not provide enough space and privacy for families who are now occupying it. Alterations and additions help partially to solve this problem.

Department of Labor estimates, based on building-permit data, of the annual expenditures [104] for residential alterations and additions show that the general trend in volume of this kind of construction has been upward (table 224). The trend has been roughly parallel to the increase in number of households,[105] as might be expected (fig. 116).

During the forthcoming 45 years, it appears reasonable to expect that volume of alterations

[104] Converted to 1953 prices of new residential construction. While the prices of alterations and repairs are probably not exactly the same as those for new construction, no separate index of alterations-and-additions prices is available. The index for new-construction prices appears to be a more reliable deflator than any other presently available.

[105] A comparison of the volume of alterations and additions and the growth in the Nation's stock of dwelling units would be even more appropriate. Such a comparison, however, cannot be made on a long-term basis because there was no Census of Housing prior to 1940. Reasonably reliable estimates of the number of households extend back to 1915 and beyond.

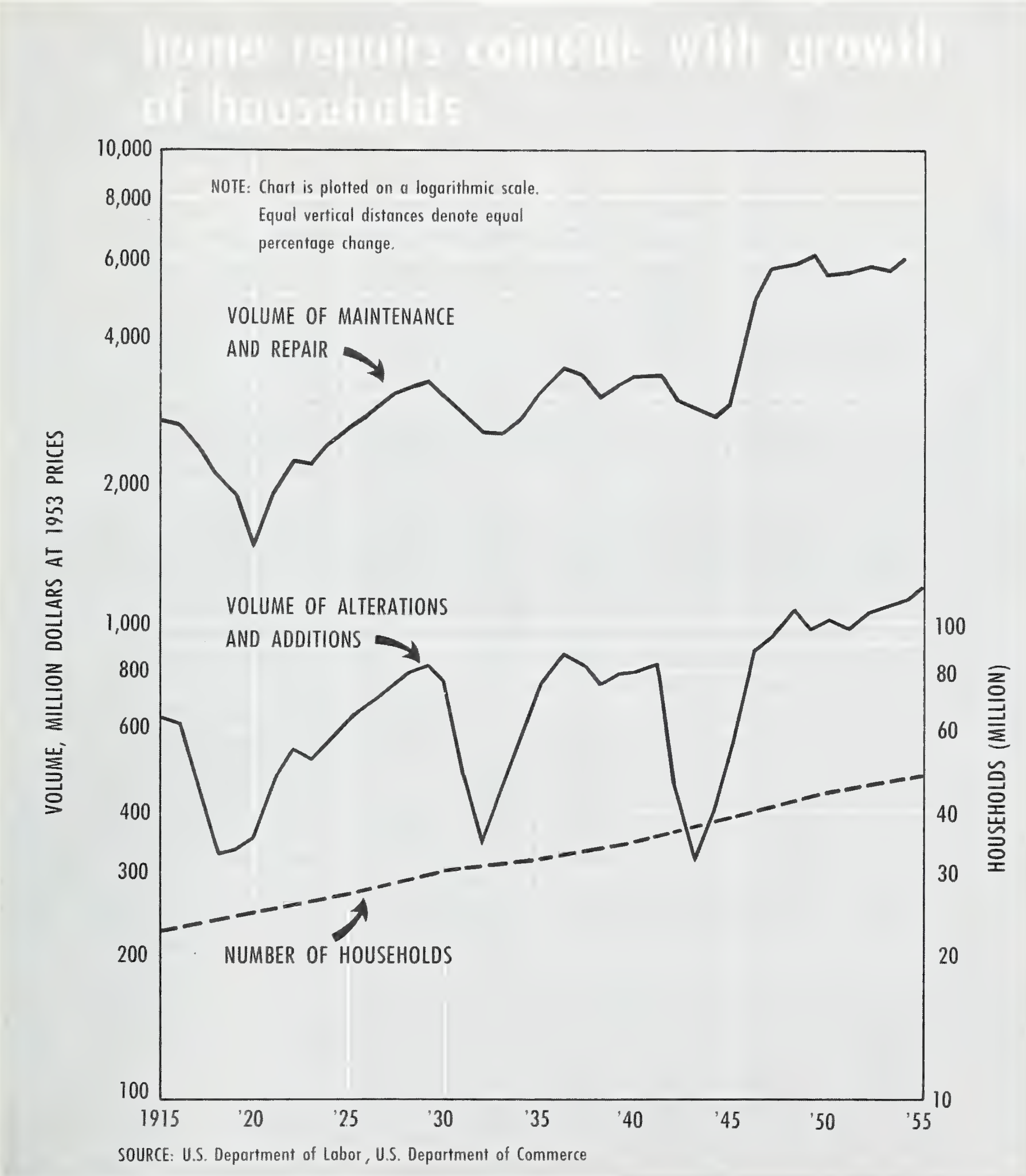

Figure 116.—Estimated volume of residential alterations and additions, 1915–55; and of residential maintenance and repair, 1915–54; in dollars at 1953 prices; number of households, 1915–55.

and additions will not be less than the 1950–55 annual average of $23.80 per household:

	Number of households (million)	Volume of alterations and additions in dollars at 1953 prices: Total volume (million)	Per household (dollars)
1950	43.6	$1,012	$23.2
1951	44.7	976	21.8
1952	45.5	1,063	23.4
1953	46.3	1,108	23.9
1954	46.9	1,138	24.3
1955	47.8	1,246	26.1
1975	65.0	1,550	23.8
2000	91.0	2,166	23.8
	101.0	2,400	23.8

The lesser of the two projections for 2000 is based on a total population of 275 million; the greater on a population of 360 million.

Residential Maintenance and Repair Involves Replacement of Lumber

Maintenance and repair of residential property include a rather wide range of work that does not change the capacity nor the service function of the building. From the standpoint of expenditure, the largest item is probably painting, but also included are renewal of floors, roofs, porches, and other parts of dwellings. In older houses, maintenance and repair may involve recovering exterior walls or renewal of sills, and even floor joists. A 1954 sample survey by the Bureau of the Census [106] showed that more than half of the expenditure being made by owner-occupants was on housing more than 25 years old, indicating that a major part of maintenance and repair is probably in the form of replacements of components subject to deterioration.

Estimates of the annual expenditure for residential maintenance and repair (converted to dollars at 1953 costs of new residential construction) show fluctuations in volume similar to those of alterations and additions, but maintenance activity has been far more constant. Both suffered about the same percentage decrease during and immediately after World War I; but the decreases in maintenance and repair activity during the early 1930's, and during World War II, were comparatively mild. The probable explanation is that a large part of maintenance and repair cannot be postponed; alterations and additions can be deferred. Since the end of World War II, the volume of maintenance and repair has been far above any previous level. This is probably a reflection of higher standards of maintenance, increased owner-occupancy, and favorable economic conditions.

In general, as disposable personal income increases, it is reasonable to expect that the standards of residential maintenance and repair will rise and thus increase the volume of such activity at a rate that will not be less, and may be somewhat greater than the average outlay per household during the period 1950–54:

	Number of households (million)	Volume of residential maintenance and repair, in dollars at 1953 costs: Total volume (million)	Per household (dollars)
1950	43.6	$5,408	$124
1951	44.7	5,469	122
1952	45.5	5,637	124
1953	46.3	5,519	119
1954	46.9	5,939	127
1975	65.0	8,000	124
2000	91.0	11,800	130
	101.0	13,000	130

The 1952–75 increase would amount to 42 percent and the 1952–2000 increase would be either 109 percent or 131 percent, depending on whether households by that time total 91 million or 101 million.

Nonresidential Maintenance and Repair Related to Gross National Product

Estimates of expenditures for nonresidential maintenance and repair (other than railroad and farm), compiled by the Department of Commerce from a variety of sources,[107] show that volume has apparently increased at a fairly steady rate, with the exception of the deep slump during and immediately after World War I (table 225 and fig.

TABLE 225.—*Estimated volume of nonresidential maintenance and repair construction (excluding railroad and farm), 1915–54*

[At 1953 prices] [1]

Year	Volume	Year	Volume	Year	Volume
	Million dollars		Million dollars		Million dollars
1915	2,424	1929	4,085	1943	4,166
1916	2,202	1930	4,315	1944	4,591
1917	1,939	1931	4,037	1945	5,338
1918	1,894	1932	4,048	1946	5,867
1919	1,937	1933	3,388	1947	5,668
1920	1,846	1934	3,689	1948	5,857
1921	2,694	1935	3,819	1949	6,162
1922	3,015	1936	4,720	1950	6,294
1923	2,879	1937	4,314	1951	6,441
1924	3,156	1938	4,664	1952	6,600
1925	3,398	1939	4,611	1953	6,636
1926	3,657	1940	4,557	1954	7,116
1927	3,857	1941	4,575		
1928	3,897	1942	4,188		

[1] Derived from Department of Commerce estimate of annual expenditure by use of implicit construction-cost index for new nonresidential construction. Implicit cost index based on relationship of annual expenditures to dollar volume at 1953 costs.

Source: U. S. Department of Commerce and U. S. Department of Labor. *Construction Volume and Costs, 1915–1954.* Washington, D. C. 1956.

[106] U. S. Bureau of the Census. *Housing and Construction Reports, Alterations and Repairs.* Ser. H–101, No. 1. 1954.

[107] The Department has warned that such estimates are subject to rather large margins of error. For that reason, it appears best to treat nonresidential maintenance and repair as a whole, rather than by type classification.

117). The decreases that occurred during the depression years and during World War II were comparatively mild. The long trend represents an average rate of increase slightly under 3 percent compounded annually, only slightly less than the average annual increase in gross national product during the same period. The similarity is, of course, not surprising. The facilities being maintained in usable condition are those employed in the production of the Nation's output of goods and services. The expansion of productive facilities and the expansion of output would be expected to progress at about the same rate.

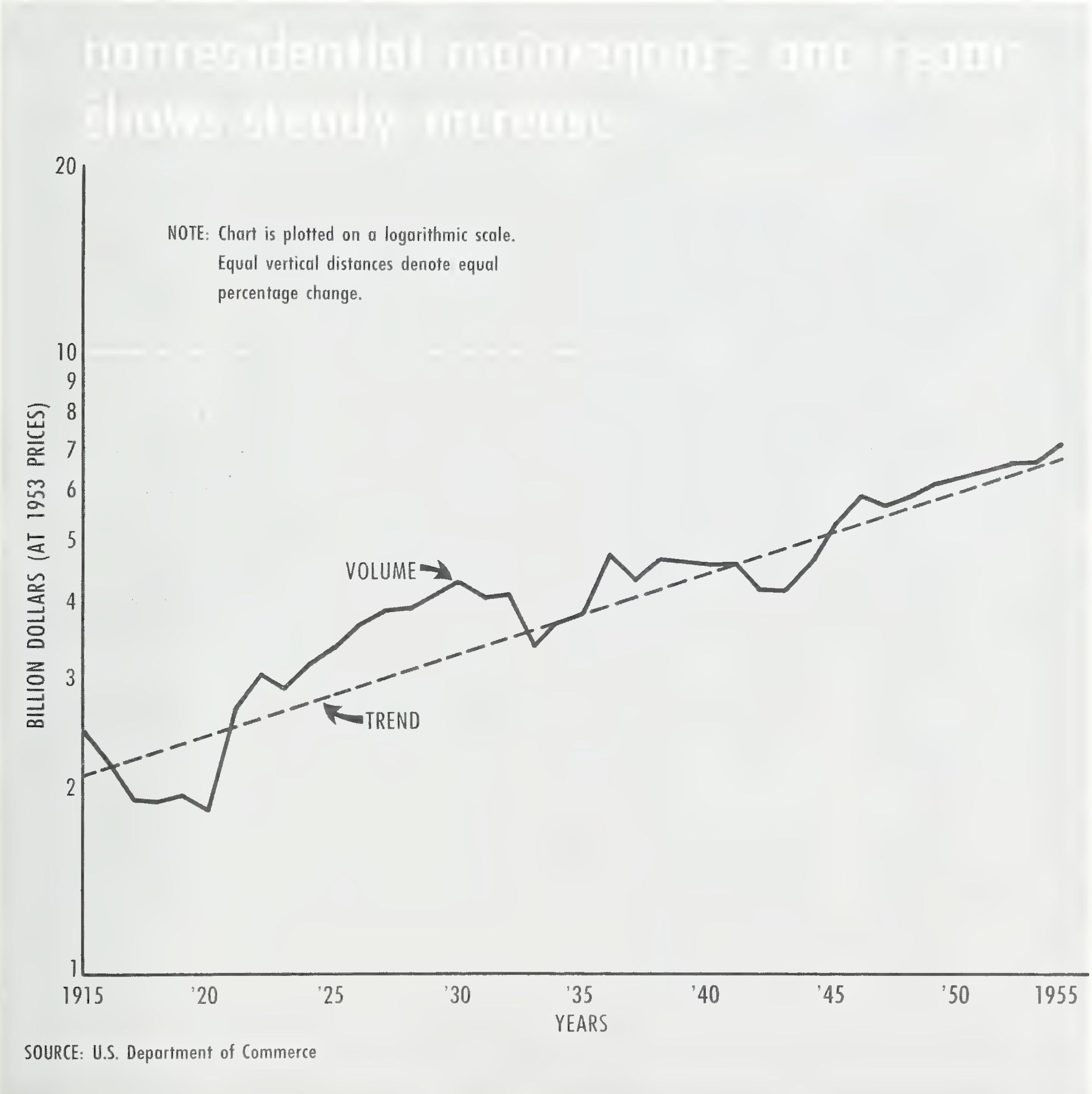

Figure 117

It appears reasonable to expect that the volume of nonresidential maintenance and repair will continue to increase at about the same rate as during the past 40 years:

	Quantity in dollars at 1958 prices (million)
1952	$6, 600
1975	12, 300
2000	25, 700
	31, 000

The lesser of the two estimates for 2000 is based on gross national product at $1,200 billion; the greater on gross national product at $1,450 billion.

Projections of Demand for Lumber for Maintenance and Repair Construction

Information bearing directly on quantity of lumber consumed in maintenance and repair is extremely scarce. Few estimates are available.[108] The approach here, with certain modifications, relies on the lumber use per dollar of expenditure factors applicable to related new construction.

In 1953, expenditures for new nonfarm residential construction totaled $10,555 million and 1,103,800 dwelling units were started.[109] Average expenditure per unit was $9,562. As previously indicated, the average lumber content per dwelling unit built in 1953 was probably about 10,000 board-feet. On that basis, lumber used in new residential construction must have been approximately 1.0 board-foot per dollar of expenditure.

It seems reasonable to assume that lumber use per dollar of expenditure for residential alterations and additions is about the same as for new construction. It also seems reasonable to expect that the anticipated rate of substitution of plywood, hardboard, and other materials for lumber in new residential construction will prevail in alterations and additions. Allowing for that substitution at about the same rate as previously allowed for in new construction, the lumber use per dollar of expenditure for alterations and additions may decrease from the present estimated 1.0 board-foot per dollar to about 0.90 in 1975 and to 0.88 by 2000, assuming no change in lumber's relative price.

Residential maintenance and repair, as previously noted, includes a large component of exterior painting and interior redecoration. Practically no lumber is used in either of these activities. But it has also been pointed out that more than half the expenditure for maintenance and repair, made by homeowners in 1954, was for work on structures that were more than 25 years old. Most of that work undoubtedly required a considerable quantity of lumber. Lumber use per dollar of expenditure would appear to be less than that for new construction, but probably not more than 50 percent below. Such reasoning leads to the judgment that present lumber use in residential maintenance and repair may be in the neighborhood of 0.5 board-foot per dollar of expenditure. Bearing in mind the do-it-yourself trend, it appears reasonable to expect that use of lumber per dollar unit of work done may remain relatively constant if relative price remains constant—say at 0.45 board-foot.

Lumber in new nonresidential construction is chiefly used in concrete forms, scaffolding, shoring, bracing, and other facilitating roles. Maintenance and repair in the nonresidential construction field require these same facilities. It appears rather unlikely that they require any less lumber per dollar of expenditure than does new construction. Again, if there is no change in the relative price of lumber, there is also little reason to expect that substitution of other materials for lumber in maintenance and repair will be much different from that anticipated in new construction.[110]

The anticipated decreases in the overall lumber-use factor reflect partly the 15 and 20 percent allowances for continuation of substitution trends, and partly changes in composition of nonresidential construction. For example, the comparatively larger increase in highway construction, which has a low lumber-use factor, tends to lower the overall average factor. If such changes do occur—as implied by present indications—there will be corresponding changes in the composition of

[108] Relying in part on previous wartime experience when lumber for such use was under Government priority control, the Department of Commerce has estimated that maintenance and repair (including residential alterations and additions) absorbed 7,876 million board-feet in 1949, 8,350 million in 1950. This total embraces all maintenance and repair, including that done by railroads and on farms. Lumber used for residential alterations and additions was estimated at 876 million board-feet in 1949 and 950 million in 1950. No breakdown of the estimates for maintenance and repair was attempted. U. S. Department of Commerce. *Construction and Construction Materials*, p. 9. August 1950.

Stanford Research Institute, relying in part on information obtained from retail lumber yards, has estimated that maintenance and repair (including residential alterations and additions, and sawed ties used by the railroads) absorbed 8,700 million board-feet in 1953. Considering that the volume of maintenance and repair increased during the period 1950–53, the estimates of these two agencies—if brought to the same year—would be quite similar. Stanford Research Institute. *America's Demand for Wood, 1929–1975*, pp. 43–45. Weyerhaeuser Timber Co., Tacoma, Wash., 1954.

[109] U. S. Department of Commerce and U. S. Department of Labor. *Construction Volume and Costs, 1915–54*, pp. 2 and 43. Washington, D. C. 1956.

[110] The estimated overall average lumber use per dollar of expenditure for new nonresidential construction (excluding railroad and farm) in 1952 and the projections for 1975 and 2000 are as follows:

	Expenditure (million dollars)	*Lumber consumption or demand (million board-feet)*	*Lumber use per dollar (board-foot)*
1952	19, 419	5, 410	0. 279
1975	35, 000	7, 439	. 213
2000	67, 000	13, 400	. 200
	80, 000	16, 200	. 200

nonresidential maintenance and repair. Modification of these factors for new construction before applying them to maintenance and repair does not appear to be called for.

Application of these factors (overall lumber use per dollar of expenditure) to estimated 1952 expenditures for the various kinds of maintenance and repair construction indicates that 5.7 billion board-feet was probably used for this purpose in 1952 (table 226). Medium projected demand by 1975 is expected to be 33 percent higher and by 2000, 114 percent higher than the 1952 figure. The upper projection for 2000 is 137 percent above 1952.

TABLE 226.—*Estimates of lumber consumption for maintenance and repair construction in 1952; projections of demand in 1975 and 2000*

[Million board-feet]

Item	Residential maintenance and repair [1]	Nonresidential maintenance and repair [2]	Total
Consumption in 1952	3, 900	1, 800	5, 700
Projections to 1975:			
Lower	4, 300	2, 100	6, 400
Medium	5, 000	2, 600	7, 600
Projections to 2000:			
Lower	5, 000	3, 000	8, 000
Medium	7, 200	5, 000	12, 200
Upper	8, 000	5, 500	13, 500

[1] Including residential alterations and additions.
[2] Not including that done by railroads and farms.

In the case of the lower projection, increases in the relative price of lumber may affect lumber use per dollar of maintenance and repair expenditures to about the same extent as they affect new construction. Lumber demand in 1975 for residential maintenance and repair may be about 15 percent below the medium projection; for 2000, it may be about 30 percent below. The corresponding reductions for nonresidential maintenance and repair lumber demand are about 20 percent and 40 percent. Overall, the lower projection for 1975 is 16 percent below the medium projection and, for 2000, it is 34 percent below.

Railroads' Use of Lumber Consists Chiefly of Ties

About 5 percent of all lumber consumed in the United States during recent years has been used by the railroads—chiefly in the form of sawed ties. Lumber is also used in building and repairing freight cars, and in construction and maintenance and repair of bridges, buildings, and other facilities.

Many Factors Affect Tie Requirements

Railroad tie requirements are influenced by miles of track operated, miles of additional track laid annually, number of ties per mile of track, size of ties laid, and the tie replacement rate.

The mileage of railroad track operated in the United States decreased 49,000 miles between 1930 and 1955 (table 227). The greater part (29,000 miles) of that decrease occurred in the 1930's. From 1940 to 1955, the decrease amounted to 20,000 miles. Present indications point to some further decrease in the mileage of track—partly through abandonment of unprofitable branch lines and partly through continuing relocation of main lines on straighter and more favorable grades. These reductions in mileage of track operated can, however, hardly be regarded as a fundamental trend; they are more in the nature of readjustments of the railroad system to enable it to perform those services for which it is best adapted.

Assuming that the readjustment phase has not yet run its full course, it appears likely that the mileage of railroad track in operation in 1975 will be in the neighborhood of 360,000 miles, or about 11,000 less than it was in 1955. With an economy of the size anticipated by 2000, however, it is hardly conceivable that the railroads could do their job without a substantial increase of multiple-track lines, of passing tracks, of crossovers and turnouts, and of yard switching tracks. How much increase is a matter of judgment, but it

TABLE 227.—*Mileage of track operated by line-haul railways and by switching and terminal companies in the United States, 1930–55* [1]

[Thousand miles]

Year	Track operated	Year	Track operated	Year	Track operated
1930	420	1939	391	1948	378
1931	418	1940	389	1949	378
1932	416	1941	386	1950	377
1933	411	1942	382	1951	377
1934	407	1943	381	1952	375
1935	404	1944	380	1953	374
1936	401	1945	380	1954	373
1937	398	1946	379	1955	371
1938	394	1947	378		

[1] These figures include the miles of road operated by electric railways reporting to the Interstate Commerce Commission. Since mileage of road is invariably less than mileage of track, inclusion of these road-mileage figures involves a small underestimate of total track mileage. Also not included is a comparatively small mileage of track operated by those intrastate railroads which are not required to report to the ICC.

Source: U. S. Interstate Commerce Commission. *Statistics of Railways in the United States* (ann. issues 1930–53) and *Transport Statistics in the United States* (ann. issues 1954–55). Washington, D. C.

appears reasonable to expect that there may be at least 400,000 miles of track in operation by 2000, still 20,000 miles short of the trackage being operated in 1930.

The laying of 1,000 miles of new track requires about the same volume of new ties as that needed for normal annual maintenance of about 33,000 miles of existing track. (Ties salvaged from abandoned track are not often used in laying new track.) New track includes new lines and extensions, conversions of single-track to multiple-track road, passing tracks, sidings, and yard switching track. The annual average mileage of new track laid by the Class I railroads during the period 1940–55 was 1,261 miles (table 228). Assuming that the laying of new track by all other classes of railroad was roughly proportional to the mileage of road, the total new trackage laid must have averaged around 1,350 miles per year.

Most new track is designed to speed traffic and improve service. There is reason to expect that the mileage of new track being laid by 1975 may be around 1,500 miles per year. By 2000, it may be something like 2,000 miles per year—if, as previously suggested, the net mileage of railroad track increases moderately between 1975 and 2000.

The trend is toward more ties per mile of track. When the railroads were first built, the standard practice was to space crossties 2 feet from center to center, or 2,640 ties per mile. By 1940, the number of ties under tracks maintained by the Class I railroads averaged 2,994 per mile. By 1955, that average had increased to 3,020 per mile (table 229). At least one major railroad has installed 3,250 ties per mile in new track. On the basis of expected improvement of roadbeds in the future, it appears reasonable to assume that the number of ties under tracks by 1975 will average around 3,050 per mile, and by 2000 around 3,100 per mile.

TABLE 228.—*Miles of new track laid by Class I railroads,[1] 1940–55*

Year	Miles laid	Year	Miles laid
1940	697	1949	1, 096
1941	1, 147	1950	1, 090
1942	1, 879	1951	1, 387
1943	1, 623	1952	1, 538
1944	1, 246	1953	1, 479
1945	1, 119	1954	1, 001
1946	1, 065	1955	1, 172
1947	1, 202	Average 1940–55	1, 261
1948	1, 433		

[1] Railroads having annual revenues of $1,000,000 and above.

Source: U. S. Interstate Commerce Commission. *Statistics of Railways in the United States* (annual issues 1940–53); *Transport Statistics in the United States* (1954, 1955). Washington, D. C.

TABLE 229.—*Miles of maintained track laid with crossties and number of crossties in place, Class I railroads, 1940–55*

Year	Miles of track	Number of crossties in place	Average number of ties[1] per mile
	Thousand	*Thousand*	*Ties*
1940	337	1, 008, 096	2, 994
1941	335	1, 003, 636	2, 993
1942	332	995, 140	2, 996
1943	331	995, 258	3, 005
1944	331	994, 314	3, 002
1945	331	991, 388	2, 996
1946	331	992, 440	3, 002
1947	330	991, 828	3, 003
1948	331	993, 212	3, 002
1949	331	992, 247	3, 001
1950	330	992, 173	3, 009
1951	330	991, 654	3, 009
1952	329	991, 393	3, 012
1953	328	991, 025	3, 020
1954	328	988, 342	3, 017
1955	325	982, 806	3, 020

[1] Computed from track-mileage and number-of-crossties data before rounding. Temporary reversals of the general trend in number of ties per mile probably due to margin of error in the basic statistics.

Source: U. S. Interstate Commerce Commission. *Statistics of Railways in the United States* (annual issues 1940–53) and *Transport Statistics in the United States* (1954, 1955). Washington, D. C.

Along with this increase in the average number of ties per mile, there has also been an increase in the average size of ties laid. In 1916 the average crosstie contained about 32 board-feet. By 1955, it had increased to 38.6 board-feet.[111] With the trend toward installation of heavier track, it appears very likely that the average size of crosstie will continue to increase for some time, and that the average crosstie laid in 1975 will contain at least 42 board-feet and in 2000 at least 46 board-feet.

The most important of all trends influencing past railroad tie requirements—and one that has almost run its full course—has been the replacement of untreated ties with treated ties. In 1940, about 18 percent of all crossties under rails in the United States were untreated. By 1955, untreated ties had been reduced to about 4 percent (table 230). The average service life of untreated ties, under most conditions, is from 5 to 10 years. Treated ties, on the other hand, can be expected to last for 30 to 35 years.

[111] Based on the number and cubic footage of crossties treated in 1955. *See* U. S. Forest Service in cooperation with the American Wood-Preservers Association *Wood Preservation Statistics*, 1955, Washington, D. C. 1956.

TABLE 230.—*Reported number of crossties in tracks maintained by Class I line-haul railroads, estimated number in all railroad tracks, and distribution as to treated and untreated, 1940–55*

[Million crossties]

Year	In maintained tracks		Distribution [3]	
	Class I railroads [1]	In all railroad tracks [2]	Treated	Untreated
1940	1,008	1,087	895	192
1941	1,004	1,077	901	176
1942	995	1,067	900	167
1943	995	1,067	919	148
1944	994	1,065	930	135
1945	991	1,061	936	125
1946	992	1,062	948	114
1947	992	1,060	957	103
1948	993	1,059	964	95
1949	992	1,058	973	85
1950	992	1,058	982	76
1951	992	1,057	988	69
1952	991	1,054	991	63
1953	991	1,054	996	58
1954	988	1,049	998	51
1955	983	1,045	1,002	43

[1] U. S. Interstate Commerce Commission. *Statistics of Railways in the United States* (annual issues 1940–53); *Transport Statistics in the United States* (1954, 1955). Washington, D. C.

[2] Based on miles of track operated by Classes I, II, and III line-haul railways, by switching and terminal companies, and by electric railways reporting to the Interstate Commerce Commission. Does not include the comparatively small mileage of track maintained by intrastate railroads not required to report to the ICC.

[3] Estimate based on the percentage distribution of treated and untreated crossties in tracks maintained by Class I line-haul railways. References cited in footnote 1 above.

Crossties Are Needed Both for Replacement and for New Track

The number of crossties laid by railroads includes the number laid in replacement plus the number laid in new track (table 231). The replacement rate can be expressed as either the average number of crossties replaced per mile of track maintained or as the number of years required for full replacement of all ties in place. During the period 1940–55 the Class I railroads annually replaced 103 crossties per mile of track maintained. At such a rate, full replacement would have been accomplished in 28.9 years (table 232). Because a considerable part of 1940–55 replacement resulted in the elimination of untreated ties, future replacement may be lower than this 1940–55 average. It is therefore expected that by 1975 and 2000, the railroads will be on a 33-year replacement basis.

About 93 percent of the track mileage in operation is laid on crossties. If the average mile of track on crossties will contain 3,050 ties by 1975 and 3,100 by 2000, the corresponding average mile of all track may contain around 2,840 crossties by 1975 and 2,890 by 2000. The 1955 average for all tracks maintained by Class I railroads was 2,813 crossties per mile.

An average service life of 33 years would imply average annual replacement at the rate of about 86 crossties per mile of track operating in 1975 and about 87 per mile in the year 2000. At these rates tie replacement can be calculated as follows:

	1975	*2000*
Miles of track in operation	360,000	400,000
Average number of crossties per mile	2,840	2,890
Number of crossties in place, thousand	1,022,400	1,156,000
Annual replacement, 33-year basis, thousand ties	30,980	35,000
Average volume per crosstie, board-feet	42	46
Volume of annual replacement, million board-feet	1,300	1,600

The information available on mileage of new track laid by the Class I railroads during the period 1940–55 indicates that about 82 percent was laid with crossties and 18 percent with switch and bridge ties. The average number of crossties

TABLE 231.—*Crossties laid by all railroads reporting to the Interstate Commerce Commission, 1940–55*

[Million crossties]

Year	All ties laid [1]	Laid in replacement [2]	Laid in new track [3]
1940	49.2	47.5	1.7
1941	53.9	51.0	2.9
1942	56.7	52.1	4.6
1943	52.4	48.5	3.9
1944	54.4	51.2	3.2
1945	49.5	46.8	2.7
1946	43.1	40.5	2.6
1947	43.3	40.4	2.9
1948	43.6	40.0	3.6
1949	35.9	33.3	2.6
1950	35.6	33.0	2.6
1951	34.8	30.4	3.4
1952	36.5	33.0	3.9
1953	35.8	32.1	3.7
1954	27.6	25.0	2.6
1955	29.0	26.0	3.0

[1] Does not include the comparatively small number of ties laid in new track by Classes II and III line-haul railroads, and by switching and terminal companies, nor any of the ties laid by electric railways and by intrastate railroads not required to report to the Interstate Commerce Commission.

[2] By Classes I, II, and III line-haul railroads and by switching and terminal companies.

[3] By Class I railroads only.

Source: U. S. Interstate Commerce Commission. *Statistics of Railroads in the United States* (annual issues 1940–53); *Transport Statistics in the United States* (1954, 1955). Washington, D. C.

TABLE 232.—*Number of crossties laid in replacement per mile of track maintained, and period in which annual replacement would have accomplished full replacement, Class I railroads, 1940–55*

Year	Ties per mile [1]	Full replacement period, at current rate
	Number	*Years*
1940	121	23
1941	131	21
1942	135	21
1943	128	22
1944	135	21
1945	124	24
1946	106	26
1947	105	27
1948	104	27
1949	85	33
1950	86	33
1951	82	34
1952	86	33
1953	85	33
1954	66	43
1955	69	41
1940–55 average	103	28.9

[1] Based on reported number of ties in total mileage of track maintained.

Source: U. S. Interstate Commerce Commission. *Statistics of Railroads in the United States* (annual issues 1940–53); *Transport Statistics in the United States* (1954, 1955). Washington, D. C.

per mile of new track laid in 1955 was 2,580. Assuming that this relationship of mileage laid with crossties to total mileage continues about as it has been, and that closer spacing will be used in the future, the average number of crossties laid in new track by 1975 may be around 2,600 per mile and by 2000 it may be around 2,650. On that basis, the number of crossties that may be laid in new track is as follows:

	1975	*2000*
Miles of new track that may be laid	1, 500	2, 000
Average number of crossties per mile	2, 600	2, 650
Indicated demand, thousand ties	3, 900	5, 300
Average volume per tie, board-feet	42	46
Volume of ties, million board-feet	164	244

All the crosstie data presented above include both sawed ties and hewn ties, but only sawed ties are classified as lumber. In the last 50 years hewn-tie production has decreased very rapidly. A Forest Service field survey found that 10.2 million hewn crossties were produced in 1952. It is expected, however, that before 1975 all crossties will be the sawed variety.

Switch and Bridge Ties Also Will Be Required

The volume of switch and bridge ties laid annually shows considerable variation from year to year (table 233). In general, the requirement for switch and bridge ties tends to parallel that for crossties. The 1940–55 trend in volume of switch and bridge ties laid per crosstie laid (in replacement and in new track) indicates a moderate increase:

Year:	*Board-feet*	Year:	*Board-feet*
1940	3. 51	1948	3. 61
1941	3. 33	1949	3. 84
1942	3. 19	1950	3. 50
1943	3. 02	1951	3. 60
1944	3. 08	1952	3. 51
1945	3. 26	1953	3. 71
1946	2. 61	1954	4. 04
1947	3. 27	1955	3. 61

Assuming that volume requirements for crossties and requirements for switch and bridge ties closely parallel each other, the latter will increase 5.9 percent between 1952 and 1975, and 33.4 percent between 1952 and 2000. Applying these percentages to 1952 consumption (128 million board-feet) the indicated requirements for switch and bridge ties are 136 million board-feet by 1975 and 170 million board-feet by 2000.

TABLE 233.—*Volume of switch and bridge ties laid annually, 1940–55*

[Million board-feet of ties]

Year	Estimated total volume laid [1]	Laid in replacement		Laid in new track by Class I railroads [3]
		By all railroads [2]	By Class I railroads [3]	
1940	172. 5	157. 0	145. 6	15. 5
1941	179. 6	155. 0	144. 6	24. 6
1942	180. 8	145. 0	136. 9	35. 8
1943	158. 0	133. 0	124. 1	25. 0
1944	167. 7	147. 0	137. 8	20. 7
1945	161. 1	140. 0	130. 5	21. 1
1946	138. 7	113. 0	106. 2	25. 7
1947	141. 6	115. 0	108. 2	26. 6
1948	157. 6	128. 0	119. 9	29. 6
1949	137. 8	115. 0	107. 8	22. 8
1950	124. 7	105. 0	98. 4	19. 7
1951	125. 3	99. 0	92. 8	26. 3
1952	128. 2	103. 0	96. 9	25. 2
1953	132. 7	106. 0	99. 8	26. 7
1954	111. 5	91. 0	85. 3	20. 5
1955	104. 8	84. 0	79. 1	20. 8

[1] This estimate does not include a comparatively small volume laid in replacement in intrastate railroads not required to report to the U. S. Interstate Commerce Commission. It also does not include a small volume laid in new track by railroads other than Class I.

[2] An estimate based on 1940–55 average ratio of track mileage maintained by the Class I railroads to total track mileage operated. The Class I railroads maintained 94.4 percent of that total.

[3] As reported to the U. S. Interstate Commerce Commission. *Statistics of Railways in the United States* (annual issues 1940–53); *Transport Statistics in the United States* (1954, 1955). Washington, D. C.

Building and Repair of Freight Cars Will Require Lumber

Back in the 1920's, the railroads and car building companies annually consumed over a billion board-feet of lumber in building new cars and repairing those in service. Since that time, annual consumption has decreased by more than half, partly due to reduction of the number of freight cars in service (from about 2.7 million in 1928 to just over 2.0 million in 1955), but chiefly because of the substitution of steel for wood. Wood had already been displaced by steel for framing all types of cars. The further displacement has been in the exterior covering of side and roofs; the standard boxcar is now steel-sheathed. There is a similar trend toward the steel-sheathed refrigerator car. Hopper cars and tank cars, of course, have always been made almost entirely of steel.

The freight-car components for which lumber is still used extensively include flooring and interior lining of boxcars and refrigerator cars, flooring and siding slats of stock cars, flooring of gondola cars and of flat cars, and flooring and interior lining of caboose cars. For these, wood has certain advantages: Blocking and bulkheading to secure cargo in boxcars can more readily be fastened to wood. Wood lining prevents condensation in boxcars and serves as part of the insulation required in refrigerator cars. Wood floors absorb vibration better than metal, are not subject to rust or corrosion, and are easier and cheaper to repair.

Estimates of the average volume of lumber used in building various types of freight cars have been made by American Railway Car Institute: [112]

Type of car:	*Board-feet*
Box (steel-sheathed)	2, 800
Flat	1, 800
Stock	3, 300
Gondola	1, 400
Refrigerator (steel-sheathed)	5, 500

Weighted according to the type-distribution of all new cars built during the period 1940–55 (table 234), these estimates indicate an overall average of approximately 1,650 board-feet of lumber per car. Assuming that plywood (and possibly hardboard or sandwich panels) will to some extent be substituted for lumber in freight car construction of the future, it appears reasonable to assume that the cars built by 1975 may average about 1,500 board-feet per car and by 2000 about 1,400 board-feet.

Just over a million new freight cars were built and put into service on the railroads of the United States during the period 1940–55. An additional 155,000 cars were exported, chiefly during and immediately after World War II. The average number of cars built annually was 63,269 for domestic use, and 72,956 for combined domestic use and export. However, production of new freight cars has been subject to severe fluctuations.

For close to 30 years, the railroads have provided an increasing amount of transportation

[112] Transmitted by letter to the U. S. Forest Service.

TABLE 234.—*Number of freight cars built annually in the United States, by type of car, 1940–55*

Year	Total	Box	Flat	Stock	Gondola	Hopper	Tank	Refrigerator	Caboose	Others
1940	62, 341	27, 662	825	388	5, 743	24, 477	1, 395	936	187	728
1941	80, 623	41, 221	1, 859	50	13, 351	17, 491	2, 057	2, 179	110	2, 305
1942	62, 873	30, 653	2, 834		9, 597	14, 259	3, 391	809	734	596
1943	74, 953	23, 074	7, 820		23, 370	15, 006	3, 494	211	988	990
1944	81, 762	31, 510	12, 514	287	12, 476	16, 984	2, 668	940	2, 634	1, 749
1945	54, 522	26, 250	2, 498	213	12, 044	9, 619	1, 735	1, 534	141	488
1946	59, 975	29, 757	1, 406		11, 416	14, 879	805	1, 260	182	270
1947	96, 243	51, 697	1, 124	50	9, 888	20, 930	4, 321	7, 262	188	783
1948	114, 885	41, 566	846	150	13, 837	42, 193	7, 050	8, 069	327	847
1949	95, 172	17, 759	1, 880	530	18, 779	41, 701	5, 330	7, 742	627	824
1950	44, 209	21, 888	2, 393	500	7, 037	7, 808	1, 695	2, 480	80	328
1951	96, 043	41, 759	3, 120	304	22, 518	15, 722	6, 501	4, 672	488	959
1952	79, 398	23, 519	2, 005	696	14, 791	25, 977	6, 371	4, 622	503	914
1953	83, 811	24, 348	2, 655		19, 283	26, 689	5, 838	2, 798	139	2, 061
1954	38, 451	13, 452	2, 340		5, 087	7, 903	4, 164	4, 539	122	844
1955	42, 042	21, 458	1, 537	100	4, 297	7, 954	3, 980	1, 837	231	648
1940–55 total	1, 167, 303	467, 573	47, 656	3, 268	203, 514	309, 592	60, 795	51, 890	7, 681	15, 334
Annual average	72, 956	29, 223	2, 979	204	12, 720	19, 350	3, 799	3, 243	480	958
Total for domestic use	1, 012, 298	389, 109	29, 161	3, 188	161, 552	305, 939	55, 231	51, 200	4, 527	12, 391
Annual average	63, 269	24, 319	1, 823	199	10, 098	19, 121	3, 452	3, 200	283	774

Source: American Railway Car Institute. *Railroad Car Facts 1955.* New York. 1956.

service with a decreasing number of freight cars in service. This has been done by increasing the average capacity per car, by increasing the average number of cars per train, and by increasing average freight train speed. It is possible that some future reductions in loading, unloading, and switching time might be attained, but even so, it appears likely that there will be some increase of cars in service—perhaps to about 2.5 million by 1975 and to around 3.0 million by 2000. Average annual replacement requirements (on a 30-year basis) would be about 83,000 and 100,000 respectively. Making further allowance for exports, production of new freight cars in 1975 is estimated at 85,000 and in 2000 at 110,000.

Applying the above estimates of average lumber content per car, the lumber required for building new freight cars would amount to about 128 million board-feet in 1975 and 154 million board-feet in 2000.

With regard to consumption of lumber in the maintenance and repair of freight cars (including freight-car grain doors), data are available, for the years 1933, 1940, and 1948, on the total volume of lumber consumed for building new cars and for maintaining and repairing those in service. Knowing the number and types of new cars built during those years, and the approximate volume of lumber per car, it is possible to derive rough estimates of the volume of lumber apparently used for maintenance and repairs, per car in service: 136 board-feet in 1933, 227 board-feet in 1940, and 170 board-feet in 1948.[113] The differences in these figures are not unreasonable. Maintenance of cars undoubtedly was at a low ebb in 1933. In 1940, on the other hand, some 13,000 old cars were rehabilitated and put back into service.[114] The estimated 170 board-feet per car used in 1948 is probably somewhere near the normal requirement of recent years.

As time goes on, more of the older freight cars will be taken out of service. In general, these older cars contain more wood than newer cars. It is therefore to be expected that the per-car average volume of lumber required for maintenance will decrease somewhat. On the basis of that supposition, the repair and maintenance estimate for 1975 is 160 board-feet of lumber per car, and for 2000 it is 150 board-feet. The estimated 1952 lumber consumption for freight-car maintenance and repair (including grain doors and car rebuilding) was 354 million board-feet. By 1975, about 400 million board-feet of lumber may be required, and by 2000 about 450 million board-feet.

Buildings and Other Structures Provide Third Important Use

Lumber is used by the railroads in construction and maintenance and repair of bridges, trestles, grade crossings, station buildings, and of railroad-owned wharves, warehouses, grain elevators, and stock yards.[115] The Class I railroads used 490 million board-feet of lumber for these purposes—and for bridge ties—in 1944.[116] With bridge ties excluded, the requirement was probably in the neighborhood of 450 million board-feet. Later estimates are not available.

However, the general trend in volume of lumber used for railroad structures since 1944 is indicated by the number of bridge and building carpenters employed in "maintenance of way and structures." In 1944, some 15,017 carpenters were so employed by the Class I railroads. By 1952 that number had decreased to 13,791 and by 1955 it had decreased to 11,754.[117] Presumably, these men spend their time on construction and maintenance which involves fabrication of lumber and other wood products. They do not work on freight cars nor do they lay ties—except, perhaps, in bridges. Consumption of lumber in maintenance of railroad buildings and other structures would logically be proportional to the force of carpenters employed. That supposition leads to the inference that the railroads probably consumed about 400 million board-feet for these purposes in 1952 and about 350 million board-feet in 1955.

Looking to the future, it is reasonable to expect some decrease in use of lumber for these purposes. More treated lumber will undoubtedly be used in all structures exposed to the weather and there may be some substitution of other materials such as plywood. By 1975, 250 million board-feet may be used for construction and maintenance and repair of railroad structures, and by 2000, 300 million board-feet.

Projections of Railroad Demand for Lumber

Adding together the estimates of 1952 lumber consumption by railroads, developed above for ties, freight cars, and structures, the total con-

[113] Based on the following estimates of lumber consumed in million board-feet:

Year:	*Total*	*New cars*	*Car repair*
1933	332.0	5.2	326.8
1940	554.8	93.8	451.0
1948	536.4	182.9	353.5

U. S. Forest Service in cooperation with Bureau of the Census. *Wood Used in Manufacture* (1933, 1940, and 1948). Washington, D. C.

[114] This is the difference between number of new cars delivered and number of cars installed in service. *See* American Railway Car Institute, *Railway Car Facts 1955*, p. 1. New York. 1956.

[115] Construction of railroad buildings and other structures done by contract is included in the estimates of nonresidential construction.

[116] Unpublished report submitted to the Office of Defense Transportation, claimant agency for railroads in the War Production Board.

[117] U. S. Interstate Commerce Commission. *Statistics for Railways in the United States* (ann. issues 1944 and 1952); *Transport Statistics for the United States 1955*. Washington, D. C.

sumption of sawed material is 2.0 billion board-feet and total consumption of sawed and hewn material is 2.4 billion (table 235). The sums of the estimates for 1975 and 2000 (all sawed material) are taken as the medium projection of future demand for lumber by railroads. The 2000 total is also taken as the upper projection since a higher estimate for that year (assuming gross national product reaches $1,450 billion) does not seem justifiable. The lower projection for 1975 is 18 percent below the medium projection; for 2000 it is about 21 percent below. This projection indicates that—with higher relative price—the railroads in 1975 would use no more lumber than they used in 1952, and only a little more in 2000:

	Million board-feet
Consumption in 1952	2, 000
Projections to 1975:	
Lower	2, 000
Medium	2, 400
Projections to 2000:	
Lower	2, 300
Medium	2, 900
Upper	2, 900

TABLE 235.—*Estimated consumption of lumber by railroads* [1] *in 1952, and projections of demand to 1975 and 2000*

[Million board-feet]

Item	1952 consumption	Projected demand	
		1975	2000
Crossties (sawed)	991	[2] 1, 464	[2] 1, 844
Switch and bridge ties	128	136	170
Car lumber [3]	473	528	604
Lumber for structures	400	250	300
Total lumber	1, 992	2, 378	2, 918
Hewn ties, lumber equivalent	391		
All sawed and hewn material	2, 383	2, 378	2, 918

[1] Includes lumber consumed by car-building companies not owned by the railroads.

[2] Part of the increase over 1952 consumption would be due to the expected disappearance of hewn crossties from the tie market.

[3] Includes lumber for new cars and for repair of cars in service. Also includes lumber for grain doors.

As Farm Output Increases, More Farm Service Structures Will Be Needed

Farm service structures include barns of various kinds, hog and poultry houses, granaries and cribs and silos, implement sheds and garages and shops, outdoor feed racks and self-feeders, farm fencing, and other facilities not classified as residential. No census of these structures has ever been taken. The available information pertaining to them consists of estimates of annual expenditures for new construction and for maintenance and repair, results of a few sampling surveys, and general knowledge of specialists who have been doing research in the field of farm-building design and efficiency.

The director of farm-building research in the Department of Agriculture has estimated (as of 1949) that farms of the United States have "about 6 million barns and 20 million other permanent structures, housing 25 million cows, 60 million hogs, 525 million chickens, and large numbers of other livestock. The buildings provide seasonal storage for about 5 billion bushels of grains and seeds, 50 million tons of hay, and 40 million tons of silage. A large part of the 500 million bushel production of potatoes, sweetpotatoes, apples, pears, and other late vegetables and fruits is stored on the farm or in community storages controlled by farmers." [118]

New methods of farm production have had considerable impact on building requirements.[119] The decrease in number of farms (from 6.8 million in 1938 to 4.8 million in 1954), and the fact that most farms have buildings of some sort, does not mean that the era of extensive construction of new farm buildings is over. Estimates of expenditure for new construction, adjusted for change in costs, indicate that the volume of new farm structures erected since the end of World War II has been considerably larger than at any time in the past (table 236). Volume of maintenance and repair of farm buildings, on the other hand, has tended to be relatively stable. The amount of this kind

[118] Ashby, Wallace. *Observations on Farm Building Activity.* In Agr. Engin., May 1949.

[119] "Each change in a farming method, production practice, economic influence or market demand may call for new building solutions. Changes already have outdated the general-purpose barn, small machinery-storage building, and such structures as the smoke house, wash house, ice house, outdoor toilet, and thresher shed.

"Current trends threatened to do away with or greatly modify the stall dairy barn, ear-corn crib, and overhead hay loft * * *

"Increased capacity per man due to mechanization tends to result in larger farms, and larger dairy, poultry, cattle, and hog enterprises.

"More and larger machines call for ample machinery-storage buildings, farm workshops, and better storage for tractor fuels.

"Adoption of soil-conservation practices results in more pasture and forage crops and consequently more storage space for them and additional shelters for animals that utilize pastures, hay, and forage.

"Major developments in corn production—hybrid seed, higher yields, and mechanical picking, husking and shelling—tend to compel the farmer to adopt artificial drying and conditioning.

"Competition and market demand has led to concentration of poultry raising and dairying into larger units where equipment and manpower can be utilized to best effect."

Carter, Deane. *Farm Buildings*, pp. 3 and 4. John Wiley and Sons, Inc., New York. 1954.

of activity, since the end of World War II, has been about the same as it was during former periods of agricultural prosperity.

On the basis of population and gross national product assumptions similar to those developed in this study, the Department of Agriculture has projected a 34 percent increase in total farm output during the period 1951–53 to 1975.[120] This would consist of a 45 percent increase in the output of livestock and livestock products and a 25 percent increase in the output of all farm crops, as shown in the tabulation in column two.

Increases of this magnitude will, of course, entail substantial increases in the requirements for housing livestock and for the storage of crops. Looking beyond to the year 2000, the increase of total farm output over 1951–53 production will probably be in the neighborhood of 80 percent on the basis of a 275-million population and in the neighborhood of 140 percent on the basis of a 360-million population.

The unusually large volume of new farm structures erected since 1945 was due in part to demands which had accumulated during World War II when materials and labor were in short

	Increase by 1975 over 1951–53 average (percent)
Livestock and livestock products	45
Cattle and calves	50
Sheep and lambs	25
Hogs	41
Milk	32
Eggs	49
Broilers and chickens	60
Turkeys	49
All crops	25
Feed grains	37
Hay	36
Oil crops	25
Food grains	[1] −9
Truck crops	43
Fruits and nuts	38
Tobacco	39
Cotton	13
All pasture	35
Total farm output	34

[1] Decrease due to present excess production.

supply and during the 1930's when farm income was low. With the trend toward a higher percentage of animal products in the diet (as personal income goes up) it appears reasonable to expect that the quantity of buildings required to shelter animals and feed will increase and that the rate

[120] Barton, Glen T., and Rogers, Robert O. *Farm Output, Past Changes and Projected Needs.* U. S. Dept. Agr., Agr. Inf. Bul. 162, p. 9. 1956.

TABLE 236.—*Estimated volume of construction of new farm service buildings and of maintenance and repairs of such buildings, 1915–54*

[In million dollars at 1953 prices]

Year	Total	New buildings [1]	Maintenance and repair [2]	Year	Total	New buildings [1]	Maintenance and repair [2]
1915	1, 030	457	573	1935	596	184	412
1916	1, 113	565	548	1936	633	239	394
1917	1, 160	699	461	1937	733	285	448
1918	992	642	350	1938	678	249	429
1919	1, 096	764	332	1939	808	290	518
1920	929	546	383	1940	772	258	514
1921	607	310	297	1941	878	313	565
1922	716	366	350	1942	674	269	405
1923	802	411	391	1943	629	314	315
1924	756	385	371	1944	512	307	205
1925	751	390	361	1945	426	277	149
1926	733	370	363	1946	933	670	263
1927	827	453	374	1947	1, 376	889	487
1928	816	411	405	1948	1, 395	918	477
1929	813	374	439	1949	1, 379	922	457
1930	563	209	354	1950	1, 487	995	492
1931	391	106	285	1951	1, 508	1, 007	501
1932	227	41	186	1952	1, 525	1, 019	506
1933	316	64	252	1953	1, 380	922	458
1934	355	85	270	1954	1, 245	832	413

[1] Based on estimates by Agricultural Marketing Service, U. S. Department of Agriculture, and published in U. S. Department of Commerce and U. S. Department of Labor *Construction Volume and Costs, 1915–1954.* Washington, D. C. 1956. Estimate in dollars at 1947–49 prices converted to dollars at 1953 prices.

[2] Same source cited in footnote 1. Estimates in dollars at year-by-year prices converted to dollars at 1953 prices by use of index of construction cost of new farm service buildings.

of farm service building construction will also increase:

	Volume of farm structures constructed (million dollars at 1953 prices)		
	New buildings	Maintenance and repair	Total
1952	1, 019	506	1, 525
1975	1, 275	580	1, 855
2000	1, 850	750	2, 600
	1, 950	850	2, 800

The lower estimates for the year 2000 are for a population of 275 million and the upper estimates are for a population of 360 million.

What these expenditure figures mean, in terms of number and types of new buildings, is indicated by the results of a 1949 sampling survey conducted by the Department of Agriculture.[121] This survey, which covered approximately 16,000 farms in 382 sampling units (usually counties) throughout the United States, showed that about 877,000 new farm service structures were erected in 1949:

	Number
Barns	107, 000
Poultry houses	204, 000
Hog houses	48, 000
Other livestock buildings	94, 000
Granaries	37, 000
Corn cribs	78, 000
Other storage buildings	62, 000
Implement sheds, shops, garages	161, 000
Other buildings	86, 000
Total	877, 000

In addition to new units, the survey found that remodeling work had been done on 337,000 structures and 1,239,000 others had been repaired.

Buildings Get Larger as Farms Get Larger

Size and design of building for a particular purpose vary from farm to farm and from region to region. As average size of farm increases there is a corresponding trend toward larger capacity buildings. But that change is offset to some extent by a trend toward the cheaper types of building which can more readily be converted from one use to some other, or replaced by another building of different size or design, without undue loss of investment.

In some areas of the country, for example, the pole-type dairy barn without floor or stalls is increasingly popular. A barn of this type can readily be converted to use for beef cattle. But in some other areas, the conventional two-story barn is still preferred. Barns of this type with gothic or gambrel roof and wood siding normally contain 20,000 to 30,000 board-feet of lumber. The pole-type barn, with metal roof and metal siding and large enough for 30 cows, may contain less than 10,000 board-feet.

Estimation of average lumber content per unit for the various classes of farm buildings constructed in 1949 must be very rough because of the lack of any specific survey data. The following estimates are based on analyses of farm-building plans (widely used throughout the country) and upon the advice of Department of Agriculture experts generally familiar with current trends in farm building:

	Estimated nationwide average lumber content per unit (board-feet)
Barns	10, 000
Poultry houses	3, 000
Hog houses	1, 500
Other livestock buildings	5, 000
Granaries	3, 000
Corn cribs	2, 500
Other storage buildings	3, 000
Implement sheds, shops, garages	4, 000
Other buildings	2, 000

These factors, applied to the data on numbers of building by classes, indicate that approximately 3.5 billion board-feet of lumber were consumed in this type of new construction during 1949. Since an estimated $922 million was spent for new farm service buildings in 1949, lumber consumption per dollar of expenditure may have been in the neighborhood of 3.8 board-feet. However, farmers utilize a considerable amount of previously used lumber in new buildings. With due allowance for this factor, it is likely that consumption of new lumber in 1949 did not exceed 3.0 board-feet per dollar of expenditure.

Remodeling and repair of service buildings probably involve about the same volume of lumber per dollar of expenditures as new-building construction. Assuming they do, the total volume of new lumber consumed on farms for nonresidential construction and repair in 1949 must have been in the neighborhood of 4 billion board-feet. The corresponding estimate for 1952, when volume of this activity was considerable larger, is 4.5 billion board-feet.

Looking ahead, and taking account of the trend toward larger but less elaborate buildings of lighter construction, it appears reasonable to expect that volume of lumber per dollar of expenditure will decline to about 2.75 board-feet by 1975. Assuming this trend will have run its course by that time, it seems likely that there will be no further reduction in lumber use per dollar-unit of structures.

Projections of Demand for Lumber for Farm Service Building Construction

On the basis of these factors, medium and upper projections of future demands for lumber on farms for nonresidential construction, maintenance, and

[121] Burroughs, Roy J. *Farm Housing and Construction During Defense Mobilization.* In Agr. Finance Rev., pp. 36–49. November 1951. Government Printing Office, Washington, D. C.

repair are developed. Compared to the medium projection, the lower projection is about 4 percent less in 1975 and about 14 percent less in 2000—and the factors of lumber-use per dollar of expenditure are correspondingly reduced:

	Million board-feet
Consumption in 1952	4, 500
Projections to 1975:	
Lower	4, 800
Medium	5, 000
Projections to 2000:	
Lower	6, 000
Medium	7, 000
Upper	7, 400

Lumber for Construction in Mines Expected To Double by 2000

About 2 percent of the lumber consumed in the United States in recent years has been used in mining operations. Sawed ties are used in mine railways. Sawed timbers, crossbars, capblocks, and wedges (normally in combination with round, split, or hewn timbers) are used in the "timbering" that supports the roof of underground mines. Boards and dimension lumber are used as brattice (lining material) in air passages of mine ventilating systems, in chutes, in bulkheads, and in various other facilities—including tipples and other mine structures above ground.

Almost all the lumber consumed in mining is used by underground mines. Strip, open-pit, quarry, and placer operations require virtually no lumber.

The quantity of lumber consumed per ton of product extracted from underground mines varies greatly from mine to mine. In general, the mining of seams lying at a tilt requires more elaborate timbering than the mining of seams that are comparatively level. Where overlying strata are firm and hard, the mine roof can be bolted from below with expansible-nut bolts and thus held up with little or no timbering, but this method of roof support can be used only where the mineral seam is overlaid by suitable rock structure.

Mechanization of cutting and loading operations at the underground working face requires the elimination of props to the maximum extent possible—so that machines can be freely maneuvered into working position. These mechanized operations also favor the use of continuous conveyor systems for transportation of extracted mineral to the hoisting shaft. Such equipment eliminates the need for track and mine-track ties. The damp conditions in most underground mines cause wood to decay quite rapidly. There is some trend toward the use of treated material in semipermanent underground structures, with consequent decrease in the rate at which those facilities have to be replaced.

On the other hand, about half of all fatal mine accidents are caused by roof falls,[122] and the worst mine disasters are caused by explosions of accumulated gases. In the interest of safety, there is continuing pressure for improved systems of roof support and for improved ventilating systems. In many instances such improvements entail increased consumption of lumber and other wood products per ton of output. There is also a trend toward the substitution of sawed timbers for round and hewn timbers. This does not increase the wood requirements per ton of output, but it does increase the lumber requirements.

Surveys to determine the quantity of timber products consumed in mining include four that were nationwide. According to these, the quantities of timber products consumed by underground mines were as follows:[123]

	1905	1923	1935	1950
Lumber, including sawed mine ties and sawed timbers:	*Million board-feet*			
Coal mines	242	296	347	597
Other mines	194	211	120	239
Total	436	507	467	836
Round, split, and hewn mine timbers:	*Million cubic feet*			
Coal mines	135	152	102	90
Other mines	31	22	11	18
Total	166	174	113	108
All timber products:				
Coal mines	188	218	179	222
Other mines	73	68	37	70
Total	261	286	216	292

Although the quantity of lumber consumed in mining during 1950 appears to have been greater than in previous survey years, the volume of round, split, and hewn material was less. Consumption of all timber products in 1950 was the highest of all survey years. Reduced consumption in 1935 was obviously due to the depression.

Considerably more than three-fourths of all timber products consumed in mining, and about 70 percent of the lumber, is used by underground coal mines. Coal production from underground

[122] U. S. Department of the Interior, Bureau of Mines. *Questions and Answers on Roof Support in Bituminous-Coal Mines*, p. 1. Washington, D. C. 1951.

[123] Kellogg, R. S. *Timber Used in Mines in the United States in 1905*. U. S. Dept. Agr., Forest Serv. in cooperation with the U. S. Dept. Int., Geol. Sur. Forest Serv. Cir. 49. Washington, D. C. 1906.

U. S. Dept. Comm., Bur. Census in cooperation with U. S. Dept. Agr., Forest Serv. and U. S. Dept. Int., Geol. Sur. *Mine Timber Used Underground*. Government Printing Office, Washington, D. C. 1925.

Brush, W. D. *Timber Requirements for Mines in the United States*. U. S. Dept. Agr., Forest Serv., Washington, D. C. 1938.

U. S. Dept. Agr., Forest Serv. Unpublished estimates for 1950 based on data collected by regional forest experiment stations in connection with a survey of equipment, supplies, and manpower used by forest products industries.

mines in 1952 was about 10 percent less than in 1950. The lower output of coal suggests the probability that 1952 lumber consumption in mining did not exceed 780 million board-feet. Production of round, split, and hewn mine timbers was probably in the neighborhood of 81 million cubic feet. Since mine timbers are not carried in stock to any important extent, this was apparently the 1952 consumption.

Future demand for lumber and other timber products in mining hinges largely on future demand for coal from underground mines; what that coal demand will be is exceedingly difficult to judge. On the basis of past experience, the Nation's consumption of all the energy materials (coal, petroleum, and natural gas) can be expected to increase by something like 75 percent during the period 1950–75, and probably by 200 percent during the longer 1950–2000 period.

How much this large increase of energy-materials demand will affect coal production from underground mines depends on whether new supplies of petroleum and natural gas will be discovered fast enough to keep pace with the mounting demand for energy. Other factors that enter the situation are: (a) Availability and cost of petroleum from overseas, (b) commercial use of nuclear energy, (c) commercial production of liquid fuels from oil shale and coal, and (d) trends in coal-mining technology. On the basis of present indications, it is not unlikely that the trend toward less dependence on coal will be reversed by 1975 or at least by 2000. This will be especially true if it proves economically profitable to substitute synthetic liquid fuels for petroleum. There is, however, the possibility that a new synthetic liquid-fuels industry would be based largely on oil shale and lignite coal mined by open-pit methods.

With regard to mining of the nonfuel minerals, there is less uncertainty. Demand for these will probably increase by something like 60 percent during the period 1950–75 and by 130 to 150 percent during the longer 1950–2000 period. Present indications are that a large part of this increase of demand will be met by importations, but even with such an increase there will probably be a large expansion of domestic mineral output. Exploitation of lower-grade deposits, however, will tend to favor open-pit methods in many instances.

The complexity of outlook regarding future mineral products, especially with regard to coal output of underground mines, makes any statistical projections of demand for lumber in mining rather impracticable. What has been done is to make what appear to be reasonable allowances, purely on a judgment basis. The 1975 lower estimate is about 10 percent below the median figure; for 2000 it is about 20 percent below:

	Million board-feet
Consumption in 1952	780
Projections to 1975:	
Lower	800
Medium	900
Projections to 2000:	
Lower	1, 200
Medium	1, 500
Upper	1, 600

Lumber for Manufactured Products

About 10 percent of the lumber consumed in the United States during recent years has been used in manufacture. The major item is furniture, but the manufacture of fixtures, caskets and burial boxes, vehicles (chiefly truck bodies and truck trailers), woodenware and novelties, handles, radios (including television sets and record players), and patterns and flasks each required more than 100 million board-feet in 1948 (table 237). Other products in which lesser amounts of lumber are used include: small boats and ships, agricultural implements, pencils and penholders, boot and shoe findings, sports equipment, toys, musical instruments, ladders, signs, venetian blinds, electrical equipment, matches, plumbers' woodwork, laundry appliances, house trailers, trunks and valises, and machinery.[124]

Furniture Manufacturing Requires Lumber Chiefly for Household Furniture

Lumber consumption by the furniture industry in 1954 amounted to an estimated 1,913 million board-feet—about the same as in 1948. Of the total consumed, including furniture dimension stock, wood furniture parts and frames, and lumber-core hardwood plywood, about 93 percent (1,781 million board-feet) went into household items.[125]

The output of household furniture is related to the number of furnished dwellings and to the rate at which people are replacing wornout and obsolescent furnishings. As previously mentioned, there were about 49 million dwelling units in the United States in 1952. The number is expected to increase to about 70 million by 1975 and to 99 or 110 million (depending on how fast the total population grows) by 2000. The minimum increase of household-furniture output to be expected—allowing for replacement at current rate, but with

[124] Flooring, millwork, prefabricated structures, and railroad freight cars are omitted here because lumber demand for these has already been included in the estimates relating to construction and to railroads. Shipping containers are a manufactured product, but lumber demand for all uses related to shipping will be considered later.

[125] *Census of Manufactures 1954*, Bulletins MC–25A, MC–25B, and MC–25C. 1957.

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TABLE 237.—*Lumber consumed in fabrication of certain manufactured products, specified years*

Product	1928	1933	1940	1948
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Furniture	1, 259	692	1, 260	1, 948
Fixtures	124	34	74	172
Caskets and burial boxes	156	125	154	155
Vehicles (chiefly truck bodies)	898	202	131	147
Woodenware and novelties	102	39	92	133
Handles	34	45	160	127
Radios, phonographs, sewing machines	[1] 10	26	63	122
Patterns and flasks	29	33	91	105
Ship and boat building	124	35	88	93
Agricultural implements	135	17	41	68
Pencils and penholders	38	14	29	66
Boot and shoe findings	25	21	54	57
Sports equipment	27	8	36	55
Toys	37	21	54	54
Musical instruments	101	8	27	53
Ladders	(2)	9	30	50
Signs, scenery, displays	65	9	17	45
Refrigerators [3]	142	49	34	38
Venetian blinds			50	37
Electrical equipment	40	9	19	37
Matches	115	74	74	35
Plumbers' woodwork	16	5	8	33
Laundry appliances	28	12	32	29
House trailers	(2)	(2)	(2)	29
Trunks and valises	15	4	9	28
Machinery	39	1	9	27
All other	185	65	167	151
Total [4]	3, 744	1, 557	2, 803	3, 894

[1] In 1928 survey, radios and phonographs were included in "all other."
[2] Included in "all other."
[3] Includes kitchen cabinets.
[4] Items may not add to totals on account of rounding.

Source: U. S. Forest Service. *Wood Used in Manufacture* (1928, 1933, 1940, 1948).

no allowance for improved furnishing of dwellings or somewhat larger average size of dwelling unit—may thus amount to about 43 percent during the period 1952–75 and to about 100 or 125 percent during the period 1952–2000.

Studies of family expenditure patterns have shown that families of the middle- and lower-income brackets ($10,000 per year and under) tend to spend a larger percentage of their incomes on furniture and household furnishings as their income goes up.[126] Since per capita disposable income (and family disposable income) is expected to increase by 30 percent or more in the period 1952–75 and by 80 to 100 percent in the period 1952–2000, substantial improvement in levels of living for all families, including those of the middle- and lower-income brackets, is anticipated. For the period 1929–54 as a whole, expenditures for new household furniture averaged 1.3 percent of disposable personal income (table 238). Furniture buying fell below average in 1930–38 and in 1942–45 because of economic depression and World War II. The above-average rates of expenditure in the period 1946–53 undoubtedly reflect a catching-up on purchases that had previously been deferred.

The multitudes of children born in the years 1950 through 1956 will be setting up households of their own from about 1970 onward. New household formation and new residential construction will therefore be at high levels. Under those conditions, it is reasonable to expect that the demand

[126] See, for example, *Survey of Consumer Finance 1953*, Fed. Res. Bul. July 1953.

TABLE 238.—*Disposable personal income and estimated expenditures for new household furniture, 1929–54*

Year	Disposal personal income [1]	Expenditure for new furniture	
		Amount [2]	As percent of income
	Billion dollars	*Million dollars*	*Percent*
1929	83. 1	1, 167	1. 40
1930	74. 4	905	1. 22
1931	63. 8	767	1. 20
1932	48. 7	486	1. 00
1933	45. 7	442	. 97
1934	52. 0	495	. 95
1935	58. 3	648	1. 11
1936	66. 2	830	1. 25
1937	71. 0	904	1. 27
1938	65. 7	809	1. 23
1939	70. 4	931	1. 32
1940	76. 1	1, 044	1. 37
1941	93. 0	1, 295	1. 39
1942	117. 5	1, 260	1. 07
1943	133. 5	1, 222	. 92
1944	146. 8	1, 295	. 88
1945	150. 4	1, 541	1. 02
1946	159. 2	2, 179	1. 37
1947	169. 0	2, 500	1. 48
1948	187. 6	2, 715	1. 45
1949	188. 2	[3] 2, 820	1. 50
1950	206. 1	[3] 3, 341	1. 62
1951	226. 1	[3] 3, 345	1. 48
1952	237. 4	[4] 3, 229	1. 36
1953	250. 2	[4] 3, 294	1. 32
1954	254. 4	[4] 3, 265	1. 28
1929–54 average			1. 30

[1] *Economic Report of the President, 1957*, p. 137. Government Printing Office, Washington, D. C. 1957.
[2] Forman, James B. *The Furniture Industry and Its Potential Market*, p. 14. U. S. Dept. Com. Government Printing Office, Washington, D. C. 1950.
[3] Estimate by Dewhurst, Frederic J., and Associates. *America's Needs and Resources*, p. 970. New York, Twentieth Century Fund. 1955. (Adjusted to exclude purchases of used furniture.)
[4] U. S. Department of Commerce. *Survey of Current Business*, p. 19. July 1955.

for household furniture will be exceptionally strong after 1970. With respect to 2000, the population projection of 275 million implies a relatively low rate of new household formation. Accordingly, demand for new furniture would be relatively weaker. If, on the other hand, population continues to increase at the pace implied by the population estimate of 360 million, there will be a high rate of new household formation and a larger volume of new residential construction.

Taking these probabilities into account, along with the projections of number of dwelling units, expenditures for new household furniture in 1975 and 2000 are estimated as follows:

	Million dollars (at 1953 prices)	*Index (1952=100)*
1952	$3, 229	100
1975	5, 200	161
2000	7, 000	217
	8, 500	263

Nonhousehold furniture includes business and professional types, furniture used in schools, churches, hospitals, theaters, libraries, and other public buildings and in restaurants. A large part of this furniture is used in connection with service activity of various kinds; and since per capita consumption of services in general has been increasing and will continue to increase, there is reason to expect that demand for nonhousehold furniture will increase faster than growth of population. If it increases about as rapidly as disposable personal income, the output of nonhousehold furniture (in terms of constant dollars) may expand about as follows:[127]

	Million dollars	*Dollars per capita*
1952	$517	$3. 29
1975	880	4. 10
2000	1, 360	4. 95
	1, 780	4. 95

Lumber Use in Household Furniture Varies With Changing Styles

The household furniture industry consumed 1,781 million board-feet of lumber in 1954:[128]

	Thousand board-feet
(1) Wood furniture, not upholstered	1, 319, 905
(2) Wood furniture, upholstered	365, 118
(3) Metal household furniture	24, 732
(4) Mattresses and bedsprings	71, 421
Total	1, 781, 176

Data for 1952 are not complete, but consumption in that year apparently was about the same as in 1954.[129] Comparable data for earlier years are not available.

The three principal factors that have tended to reduce the quantity of lumber required for a given output of household furniture are changes in style, substitution of other timber products for lumber, and substitution of metal for wood.

Changes in style, from the massive type in vogue a generation or more ago to the light "functional" styles now popular, have had two effects: the amount of wood per piece of new furniture is certainly less, but so is furniture durability. Sacrifice of durability means more rapid replacement. What the net effect has been is unknown. Another trend has been toward use of more upholstered furniture, and the wooden frames in this kind of furniture contain less lumber than would be required for comparable furniture, not upholstered.

In wood household furniture, lumber faces competition by plywood, hardboard, and particle board. A considerable part of the hardwood plywood used, however, is the lumber-core type. Judging from the relationship of reported consumption of hardwood lumber by the hardwood plywood industry to reported output of lumber-core hardwood plywood, this type of material contains about 0.85 board-foot of lumber per square foot of plywood.[130] Hence displacement of lumber by plywood is less consequential than it might appear to be. With regard to veneer-core plywood and the composition boards, the displacement of lumber is complete. But use of these boards is generally limited to concealed components in which strength is not an important requirement.

The 1943 Census of Manufactures shows that

[127] Dollar value of manufacturers' shipments of nonhousehold furniture. 1952 figure from *Census of Manufactures 1954*, Buls. MC-25B and MC-25C.

[128] Item 1 includes wood furniture parts and frames costing $16,251,000. Quantity estimated on basis of $300 per thousand board-feet. Also includes 44,298 thousand square feet of lumber-core hardwood plywood. Lumber content estimated on basis of 0.85 board-foot per square foot.

Item 2 includes dressed softwood lumber costing $1,126,000. Quantity estimated on basis of $85 per thousand board-feet. Also includes wood furniture parts and frames costing $23,373,000. Quantity estimated on basis of $225 per thousand board-feet.

Item 3 includes wood furniture parts and frames costing $4,304,000. Quantity estimated on basis of $300 per thousand board-feet.

Item 4 includes wood furniture parts and frames costing $5,271,000. Quantity estimated on basis of $225 per thousand board-feet.

Source: *Census of Manufactures 1954*, Bul. MC-25A. 1957.

[129] A Census Bureau survey covering 1952 household furniture production showed lumber consumption (including hardwood furniture dimension stock) at 1,605 million board-feet. This did not include wood frames purchased by the furniture manufacturers from other producers.

Purchases of wood frames in the 1954 data are lumped with purchases of wood furniture parts and cannot be segregated. Volume of lumber purchased in 1954, in the form of frames, wood parts, and in lumber-core hardwood plywood, all combined, is estimated at 233 million board-feet.

For 1952 data see Bureau of the Census, *Household Furniture and Bedding Products, 1953; Facts for Industry*, Ser. M54A-03, 1954.

[130] *Census of Manufactures 1954*, Bul. MC-24B, pp. 9, 15.

"wood household furniture" comprised 80 percent of the value of total shipments of household furniture; "metal household furniture" shipments amounted to 20 percent (table 239). Metal has made large gains against wood in porch, lawn, and outdoor furniture; kitchen furniture; dining room and dinette furniture; and in the miscellaneous category. There has been virtually no displacement of wood by metal in living room and bedroom furniture. From the standpoint of value of shipments, these are the two major categories of household furniture.

TABLE 239.—*Value of household furniture not including mattresses and springs shipped by manufacturers, 1954*

Class, according to use	Wood [1]	Metal	Total
Living room [2] ____million dollars__	833	19	852
percent__	98	2	100
Dining room and dinette million dollars__	154	127	281
percent__	55	45	100
Kitchen_________million dollars__	136	115	251
percent__	54	46	100
Bedroom________million dollars__	454	14	468
percent__	97	3	100
Porch, lawn, and outdoors million dollars__	14	55	69
percent__	20	80	100
Others and not specified million dollars__	109	86	195
percent__	56	44	100
All household furniture million dollars__	1, 700	416	2, 116
percent__	80	20	100

[1] Includes both upholstered and nonupholstered wood furniture.

[2] Includes some dual-purpose furniture such as sofa beds.

Source: *Census of Manufactures 1954*, Bul. MC–25A. 1957.

What the future holds for lumber as household-furniture material is difficult to appraise. Much depends on how much effort is made to hold this market and on consumer preferences. Lumber consumption in manufacture of household furniture during 1954 averaged 0.68 board-foot per dollar of shipments, as follows:

	Value [1] *(million dollars)*	*Lumber per dollar* [2] *(board-feet)*
Wood furniture, not upholstered______	$1, 113	1. 19
Wood furniture, upholstered_________	633	. 58
Metal household furniture___________	403	. 06
Mattresses and bedsprings___________	465	. 15
Furniture, not elsewhere classified____	16	(3)
Total and average____________	2, 630	. 68

[1] Source: *Census of Manufactures 1954*, Bul. MC–25A, p. 3.

[2] Based on estimates shown previously in footnote 128.

[3] Lumber consumption not reported.

It appears reasonable to expect that lumber use per dollar of shipments may decline to 0.60 board-foot by 1975 and to 0.55 by the year 2000. On the basis of these factors, and assuming that purchases and shipments of furniture increase to the same extent, lumber use in household furniture manufacture may increase from the 1952 estimate of 1,780 million board-feet to 2,440 million board-feet by 1975. For 2000, the estimate is 3,010 million board-feet or 3,650 million board-feet, depending on which projection of expenditures is selected.

Lumber Use in Nonhousehold Furniture Expected To Continue

Trends in use of lumber in nonhousehold furniture are variable. Metal office furniture was very popular only a few years ago, but there now appears to be some tendency to swing back toward wood. In terms of value, wood furniture represented 27 percent of total manufacturers' shipments in 1947, 17 percent in 1952, and 21 percent in 1954. The 1954 shipments were as follows:[131]

	Wood	*Metal*	*Percent wood*
Executive desks ______________thousand units__	175	361	33
Stenographer desks______do____	58	110	35
Chairs and stools________do____	817	1, 135	42
Tables and stands ____________thousand dollars__	4, 936	14, 486	25
Cabinets and cases______do____	4, 432	94, 003	5
Other furniture_________do____	6, 704	8, 112	45

The only product almost completely taken over by metal is filing cases. In all other products, wood maintains a substantial share of the market.

Manufacture of nonhousehold furniture consumed approximately 132 million board-feet of lumber in 1954—almost half of which went into public-building furniture:

	Thousand board-feet	*Percent*
Wood office furniture________________	[1] 37, 000	28
Metal office furniture________________	12, 142	9
Public-building furniture_____________	[2] 63, 890	48
Professional furniture_______________	13, 340	10
Restaurant furniture________________	[3] 5, 863	5
All nonhousehold furniture_____	132, 235	100

[1] Includes 2,037 thousand square feet of lumber-core hardwood plywood. Lumber content estimated on basis of 0.85 board-foot per square foot of plywood.

[2] Includes 3,527 thousand square feet of lumber-core hardwood plywood. Lumber content estimated as indicated above.

[3] Quantity of lumber estimated on basis of reported cost ($985,000) on basis of $168 per thousand board-feet.

Source: *Census of Manufactures* 1954, Buls. MC–25B and MC–25C.

Wood has always had a strong position in church furniture and will probably retain it. Most hospital furniture is already the metal type; changes back toward wood are unlikely. Theater and auditorium seats are predominantly metal

[131] Source: *Census of Manufactures 1954*, Bul. MC–25B.

and are also not likely to change. School furniture has shown a tendency to swing toward metal, but wood still holds a substantial share of the market.

In the professional-furniture field, wood has a weak position—except with regard to laboratory cabinets and cases where its noncorroding characteristics are an asset. For nonhousehold furniture as a whole, lumber use in 1954 amounted to 0.26 board-foot per dollar of shipments; in 1952 the ratio was probably about the same. In view of the trends discussed above there is little reason to expect any drastic reduction. Lumber use per dollar of shipments may be about 0.24 board-foot by 1975 and about 0.22 board-foot by 2000. By applying these factors to the values of nonhousehold furniture shipments, estimates of future lumber use are obtained.

The estimated 1952 lumber consumption in manufacture of all types of furniture and expected use in 1975 and 2000—assuming no change in the real price of lumber—are summarized as follows:

	Million board-feet		
	Household furniture	*Nonhousehold furniture*	*All furniture*
1952	1, 780	134	1, 914
1975	2, 440	210	2, 650
2000	{3, 010	300	3, 310
	{3, 650	390	4, 040

The increase during the period 1952–75 would amount to 38 percent. During the period 1952–2000 it would amount to 73 percent or to 111 percent—depending on whether population is then near 275 million or in the vicinity of 360 million.

Many Other Manufactured Products Require Lumber

Manufacture of the various nonfurniture products absorbed 1,946 million board-feet of lumber in 1948. Product-by-product analyses of future demand for such a long list of items—and of the volume of lumber that may be demanded in manufacture of each, is not practicable. Instead, the products are grouped according to whether demand for them is likely to follow (a) the trend of population growth, (b) trend in number of households, (c) trend of disposable personal income, or (d) trend of farm output. After grouping in each of these four categories, there is still a miscellaneous collection of products that do not appear to fit very well in any of the four categories.

The output of boot and shoe findings (last blocks and the like, used in shoe manufacture) depends on the demand for shoes—determined largely by number of people and upon the rate of footwear replacement. As lower-bracket family incomes rise, people tend to own more shoes and to replace their shoes more rapidly. Demand for shoe-manufacturing equipment may therefore increase somewhat faster than growth of population.

The output of caskets, on the other hand, depends on the number of deaths. So long as population continues to increase, the number of deaths will necessarily increase less than growth of population.

Consumption of matches is determined largely by the number of people who smoke. It appears rather doubtful that *per capita* consumption of matches in the future will be any larger than at present. Demand for matches is therefore likely to increase in direct proportion to population. This same proposition may hold with regard to demand for pencils and penholders.

While not many households use more than one refrigerator, this is one item of equipment still lacking in many dwellings—particularly in rural areas. As disposable personal income rises, output of refrigerators can be expected to increase somewhat faster than number of households. This same proposition may hold with respect to laundry appliances, venetian blinds, and plumbers' woodwork.

Some of the products under consideration are luxury or semiluxury items. Demand for such goods will probably increase at about the same rate as disposable personal income. The products in this category include: sports equipment, toys, musical instruments, radios (including television sets and record players), house trailers, woodenware, and novelties. It is probable that demand for fixtures, and for signs, scenery, and displays will also follow the disposable-income trend. All are used in the selling of merchandise, and volume of such trade is determined largely by consumer income.

Demand for agricultural implements is expected to parallel the trend of farm output; the relationship is direct but subject to trends in mechanization of agriculture and to farmers' income. Recognition of these subsidiary factors, however, is hardly necessary for present purposes.

The remaining assortment of products (ladders, handles, electrical equipment, small boats and ships, patterns and flasks, and machinery) does not appear to belong in any of the categories discussed above. Future output for such products is estimated strictly on a judgment basis.

In accordance with the reasoning reviewed above, 1952 consumption and increases in demand by 1975 and 2000 are estimated for various products (table 240). While the results are admittedly rough, errors in judgment probably tend to compensate. Applying these estimated increases in product consumption to the quantity of lumber consumed in the 1948 manufacture of each product, lumber consumption of 2,150 million board-feet is indicated for 1952 and 3,400 million board-feet by 1975. The comparable

estimates for 2000 are 5,863 million board-feet or 6,707 million—depending on level of population.

The foregoing figures, of course, contain no adjustments for the expected trend in substitution of other timber products for lumber. With allowances of 5 percent for such displacement in 1952, about 15 percent displacement by 1975, and 20 percent displacement by 2000, the estimates of lumber use in the manufacture of nonfurniture products (assuming no change in lumber's real price) are as follows:

	Million board-feet
1952	2, 040
1975	2, 890
2000	4, 690 5, 370

TABLE 240.—*Increases of population, number of households, disposable personal income, and farm output 1948–52; projections to 1975 and 2000; estimated increases of consumption of specified products 1948–52; and estimated demand in 1975 and 2000*

Item	1948	1952	1975	2000	
				With 275 million persons	With 360 million persons
Population					
Million persons	147	157	215	275	360
Index (1948=100)	100	107	146	187	245
Related items:					
Boot and shoe findings	100	108	147	195	250
Caskets and burial boxes	100	103	130	165	200
Matches	100	107	143	187	245
Pencils and penholders	100	107	143	187	245
Trunks and other luggage	100	107	143	187	245
Households					
Million households	41	46	65	91	101
Index (1948=100)	100	112	159	222	246
Related items:					
Refrigerators	100	115	165	235	250
Venetian blinds	100	115	165	235	250
Laundry appliances	100	115	165	235	250
Plumbers' woodwork	100	115	165	235	250
Disposable personal income					
Billion 1953 dollars	211	238	441	840	1, 015
Index (1948=100)	100	113	209	398	481
Related items:					
Sports equipment	100	113	209	398	481
Toys	100	113	209	398	481
Radios, etc	100	113	209	398	481
Musical instruments	100	113	209	398	481
Woodenware, novelties	100	113	209	398	481
House trailers	100	113	209	398	481
Fixtures	100	113	209	398	481
Signs and displays	100	113	209	398	481
Farm output					
Index (1948=100)	100	103	138	186	247
Agricultural implements	100	103	138	186	247
Miscellaneous					
Ladders	100	110	150	200	240
Vehicles	100	115	210	400	450
Handles	100	110	150	200	220
Small boats and ships	100	105	140	200	220
Electrical equipment	100	110	175	170	200
Machinery	100	110	175	375	400
Patterns and flasks	100	110	175	375	400
All others	100	110	150	200	250

Projections of Demand for Lumber for Manufactured Products

Medium and upper projections of demand for lumber in manufacture are obtained by adding together the above estimates pertaining to furniture and other products. The lower projection is derived from the medium estimates on the assumption that increases in the real price of lumber will result in substitution of nonwood materials for lumber amounting to roughly 10 percent by 1975 and 25 percent by 2000. In the case of the medium projection, the estimates imply a 40-percent increase in use of lumber for manufactured products during the period 1952–75, and an increase of 102 percent during the period 1952–2000:

	Million board-feet
Consumption in 1952	3, 950
Projections to 1975:	
Lower	5, 000
Medium	5, 500
Projections to 2000:	
Lower	6, 100
Medium	8, 000
Upper	9, 400

Lumber for Use in Shipping

Between 10 and 20 percent of the lumber consumed in the United States is used in the transportation and storage of food and manufactured goods. Lumber used annually for this purpose during the 1920's amounted to between 4.3 and 6.3 billion board-feet. In the depression years of the 1930's the volume used fell as low as 2.8 billion board-feet, but had risen again to an estimated 5.0 billion by 1940. The huge overseas movement of military supplies during World War II required large quantities of boxes, cases, and crates. It has been estimated that 14.5 billion board-feet of lumber was used in connection with shipping in 1944. Since the end of World War II, shipping use has varied from 5.0 to a little over 6.0 billion board-feet.[132]

Major Shipping Use Is for Wooden Boxes, Cases, and Crates

The output of wooden box factories consists principally of nailed and wirebound wooden boxes, cases, and crates. Part of these containers are used in hauling fresh fruits and vegetables from fields and orchards to packing plants and in shipments from packing plants to final destinations. The remainder of these factory-made containers are used in the storage and transportation of a large variety of manufactured goods.

Consumption of lumber by the box factories in 1947 amounted to 1,910 million board-feet. The corresponding figure for 1954 was 1,416 million board-feet. Estimates for intervening years are based on the number of production workers employed:

	Lumber used (million board-feet)	*Production workers employed (number)*
1947	1, 910	44, 606
1949	1, 381	35, 264
1950	1, 451	36, 504
1951	1, 643	39, 891
1952	1, 543	38, 118
1954	[1] 1, 416	35, 871

[1] Includes 652 thousand square feet of lumber-core hardwood plywood. Lumber content estimated on the basis of 0.85 board-foot per square foot of plywood. Source: *Census of Manufactures 1954*, Bul. MC–24C, pp. 3, 13.

Box-factory consumption in 1954 was 26 percent less than in 1947, but box-factory employment declined slightly less than 20 percent. The reason for this difference is attributed to the shift from nailed wooden containers toward wirebound containers. Most wirebound boxes and crates are made principally of veneer and some contain no lumber at all.

In view of the known shift from wooden containers to fiber cartons, these Census data are somewhat surprising. The output of nailed and wirebound wooden containers apparently declined less than 20 percent.[133] The nailed or wirebound wooden container still holds a prominent place in the transportation of fresh fruits and vegetables—partly because it affords better protection to the contents, and partly because it is not weakened by refrigerator-car moisture. Various alternative methods of shipping are being developed and used, but so far with limited application. The wooden box, case, or crate also has its place in shipment of those manufactured goods which require a high degree of protection. Shipments in freight cars normally require more rigid containers than shipments in trucks. Goods shipped in the export trade usually require strong containers that will not crush when superimposed upon each other in ships' holds.

[132] All these estimates are subject to considerable margins of error because complete information on volume of lumber consumed in shipping uses has never been collected. Only rough estimates have been made with respect to (a) lumber that goes into the large quantity of wooden boxes, cases, and crates made by container users, themselves—both industrial and military; and (b) with respect to lumber used for "dunnage" to hold cargo in place aboard freight cars and in the holds of ships. The use-sectors for which Census or other data are available include lumber used by the box factories, and lumber used in fabrication of pallets.

[133] Although employment declined almost 20 percent, it is relatively certain that productivity per man-year increased. Taking this factor into account, there is a strong likelihood that output, in terms of quantity of containers, decreased not more than 10 percent—possibly less. Data on quantity of various types of containers shipped by box factories in 1954 are not available. Comparisons of dollar value of shipment are not usable as an index of quantity shipped because of the many price changes.

Several current trends favor the wooden box. The most notable is the widespread adoption of fork-lift equipment for moving goods into and out of storage and for loading and unloading freight cars and trucks. Such labor-saving equipment can be used most efficiently for goods packed in palletized units. Such a unit normally consists either of a pallet-mounted wooden box or of a pack of filled containers firmly fastened to a pallet with metal strapping. In either case the box or container-pack must be strong enough to permit pallet loads to be superimposed on each other. Where palletized units can be stacked on top of each other by lift truck, there is likely to be an important saving of warehouse space in addition to saving of labor.

While these new methods of materials handling will certainly not restore the wooden box to its former dominant position among shipping containers, the substitution of fiber cartons for wooden containers will probably be retarded. With the expected increase in national output of goods to be transported—both in domestic and in overseas trade—the demand for wooden containers can be expected to expand at least to a moderate extent, during the next 20 and the next 45 years.

Estimates of 1940–47 annual quantities of lumber consumed in fabrication of wooden boxes, cases, and crates (those made in box factories and also those made by container users) have been extended to 1954 on the supposition that total consumption of lumber for use in fabrication of all wooden containers, other than cooperage, has probably followed about the same trend as that reported by the box factories (table 241). This method of estimation indicated that 1952 total lumber consumption may have been in the neighborhood of 4,300 million board-feet.

Estimation of future demand for wooden-container lumber by statistical methods does not appear practicable—partly because the influence of World War II is so strongly reflected in the data available, and partly because the prospective influence of new material-handling technology is such an imponderable factor.

The medium projection of 1975 demand for lumber in wooden containers is estimated at 5,800 million board-feet. That amount would be about 35 percent above the estimated 1952 consumption but somewhat below estimated 1946 consumption. Medium projected demand in 2000 is estimated at 7,000 million board-feet and upper projected demand at 7,500 million. These latter figures imply increases of about 20 and 30 percent over the 1975 estimate.

More Pallets Required as Materials Handling Becomes Mechanized

The pallet is an offshoot from the invention and successful operation of the fork-lift truck. Large-scale use of these trucks and other equipment for mechanized handling of materials started in 1938 when the Navy began experiments in connection with its program to expand warehouse and port-terminal facilities. Success of the experiment quickly led to adoption of the system by the whole military establishment. An estimated 90 million pallets were acquired by the military services during the period 1941 through 1945.

Since the end of World War II use of pallets by private industry has increased very rapidly. The trend has been greatly stimulated by improvements in fork-lift trucks and other equipment for handling materials. It is no exaggeration to say that materials-handling technology in factories and in warehouses has virtually been revolutionized during the past decade. The system is now rapidly expanding to include handling of materials in transportation.

Pallets vary considerably both in size and design. The National Wooden Pallet Manufacturers Association has estimated that, on the average, about 25 board-feet of lumber is used per pallet and that annual production, chiefly for use in private industry, has increased from 23 million in 1950 to 43 million in 1955:

	Pallets produced (million)	*Lumber consumed (million board-feet)*
1950	23	575
1951	27	675
1952	33	825
1953	40	1,000
1954	36	900
1955	43	1,075

Because the palletized handling of materials is so new and has been expanding so rapidly, estimates of wood-pallet production in 1975 and by 2000 must rest almost entirely on judgment. As the use of pallets extends into transportation, demand can be expected to increase. Once a saturation point is reached, pallet output would be expected generally to keep pace with the increases in output of merchandise, and to supply the necessary replacements for wornout pallets. Little is known, however, about what the average service life of pallets will be.

In view of these considerations, demand for pallets may increase to around 70 million per year by 1975. With the anticipated further large increase in output of merchandise, and a larger stock of pallets to maintain, output by 2000 may be in the neighborhood of 150 million or 175 million per year. Since the material used in pallet manufacture is chiefly the lower grades of hardwood, lumber should have no great difficulty in maintaining its present position as the principal pallet material.

Based on the foregoing line of reasoning, the medium projections of demand for pallet lumber (allowing for some reduction in lumber used

TABLE 241.—*Estimated total volume of lumber used in fabrication of nailed and wirebound boxes, cases, and crates, specified years, 1940–54*

Year	Total lumber use	Lumber used by box factories	Index of box-factory consumption
	Million bd.-ft.	*Million bd.-ft.*	*(1947=100)*
1940	4, 515		
1941	5, 732		
1942	9, 122		
1943	12, 080		
1944	11, 762		
1945	10, 765		
1946	5, 859		
1947	5, 300	1, 910	100
1949	3, 816	1, 381	72
1950	4, 028	1, 451	76
1951	4, 558	1, 643	86
1952	4, 293	1, 543	81
1954	3, 922	1, 416	74

Source: Estimates for 1940–47, U. S. Department of Commerce, *Containers and Packaging*, December 1948. Box-factory consumption 1947 and 1954, *Census of Manufactures 1954*, Bul. MC–24C, 1957. Data not available for years prior to 1947.

per pallet) is 1,700 million board-feet by 1975 and 3,500 million board-feet by 2000. The upper projection for 2000 is 4,000 million board-feet. The increase during the period 1952–75 is 106 percent—but 30 percent of that long-term increase had already occurred during the period 1952–55. The projected further increase during the period 1975–2000 would amount to about 106 percent or to 135 percent—depending on growth of population and of the Nation's economy.

Lumber Is the Principal Material Used for Dunnage

Dunnage is the wooden bracing and blocking used to prevent cargo from shifting during transit in freight cars and ships. Lumber is the principal material used for this purpose.

Information on quantity of lumber consumed annually as dunnage is incomplete. The last survey of wood used in manufacture indicated that manufacturing establishments used 612 million board-feet of dunnage lumber during 1948.[134] This probably included about all the dunnage used in freight cars, but probably not much of that used in loading ships. It has been estimated from time to time that 1 billion board-feet of lumber is normally used for all types of dunnage. This estimate is probably somewhere near the actual consumption, but there must be a considerable year-to-year fluctuation of quantity used.

Changes in methods of shipping certain heavy merchandise, such as automobiles, tend to reduce the quantity of dunnage required in railroad transportation. The expansion of United States overseas exports of manufactured goods, on the other hand, probably increases the amount of dunnage required in that trade. Since export trade in manufactured goods is expected to increase substantially by 1975 and 2000, medium demand for dunnage lumber has been projected at 1.2 billion board-feet in 1975 and both medium and upper projected demands are the same at 1.5 billion by 2000.

While these figures involve increases of 20 percent by 1975 and of 50 percent by 2000, both imply a rather drastic reduction of dunnage use per ton of merchandise moving through the channels of domestic and export commerce.

Projections of Demand for Shipping Lumber

The above series of estimates of lumber used in connection with shipping, added together, total the medium and upper projections to 1975 and 2000. The lower projection provides estimates 15 percent below the medium projection for 1975 and 35 percent below the medium projection for 2000, resulting from the assumption that there will be a substantial increase in the real price of lumber. The medium projection for 1975 is 42 percent above 1952 consumption and for 2000 it is 96 percent above:

	Million board-feet
Consumption in 1952	6, 125
Projections to 1975:	
Lower	7, 400
Medium	8, 700
Projections to 2000:	
Lower	7, 800
Medium	12, 000
Upper	13, 000

TRENDS IN LUMBER PRICE AND CONSUMPTION

Lower projected demand for lumber assumes a substantial increase in price relative to competing materials and is based on an analysis of trends in lumber price and consumption. To obtain some conception of the possible impact of price-change on quantity of lumber consumed in the past, the long-term trend in average lumber price can be compared with the long-term trend in lumber

[134] U. S. Forest Service, *Wood Used in Manufacture 1948*, pp. 62 and 63. Washington, D. C. 1951.

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consumption.[135] But in order to make such a comparison in any meaningful way, several changes in the form of basic data are required.

Real Price Increased 190 Percent, 1900–1954

The index of annual average lumber price reflects change, not only in the price of lumber itself, but also change in buying power of the dollar. In order not to confuse one with the other, the index of lumber price is deflated by use of the all-commodity price index. The result of this procedure is an index of "real price." The increase in the real price of lumber between the years 1900 and 1952 was 190 percent (table 242).

Another measure of price change is "relative price"—the relationship of lumber price to the price of those materials with which lumber is in price competition. But precise statistical measurement of the relative price of lumber requires basic information not presently available.

A properly weighted composite price of those materials actively in price competition with lumber depends on information about the quantity of each material which actually does compete with lumber. Portland cement, for example, used in concrete-slab foundations of houses, is in direct competition with lumber; cement used in the paving of highways is not competing with lumber. There is the further complication that lumber used for concrete forms is a complement of cement—not a possible substitute for cement. Since a large part

[135] Analyses of the apparent impact of price changes (and associated factors) on quantity of a product consumed require reasonably accurate price and consumption data—extending over a considerable period of time. Historical data for certain species, grades, and sizes of lumber are available. The difficulty lies in the absence of corresponding information (by species, grade, and size) on end-use consumption of lumber. Most of the end-use consumption data available are for certain years only, and seldom indicate species or grade of lumber consumed. This gap in fundamental knowledge seriously limits the practicable analyses that can be made regarding impact of price change on quantity of lumber consumed.

TABLE 242.—*Indexes of average lumber price and real price, 1900–1954*

[1926=100]

Year	Annual average price of lumber, index	All-commodity price index [1]	Real price of lumber		Year	Annual average price of lumber, index	All-commodity price index [1]	Real price of lumber	
			Index [2]	Index smoothed by 3-year moving average				Index [2]	Index smoothed by 3-year moving average
1900	38. 1	56. 1	67. 9	----------	1928	90. 5	96. 7	93. 6	96. 6
1901	38. 3	55. 3	69. 3	68. 5	1929	93. 8	95. 3	98. 4	97. 1
1902	40. 3	58. 9	68. 4	69. 8	1930	85. 8	86. 4	99. 3	97. 7
1903	42. 8	59. 6	71. 8	69. 2	1931	69. 5	73. 0	95. 2	94. 6
1904	40. 3	59. 7	67. 5	70. 2	1932	58. 5	64. 8	90. 3	97. 6
1905	42. 8	60. 1	71. 2	74. 4	1933	70. 7	65. 9	107. 3	103. 5
1906	52. 3	61. 8	84. 6	78. 7	1934	84. 5	74. 9	112. 8	107. 5
1907	52. 4	65. 2	80. 4	80. 9	1935	81. 8	80. 0	102. 3	107. 6
1908	48. 6	62. 9	77. 3	76. 5	1936	87. 0	80. 8	107. 7	108. 5
1909	48. 6	67. 6	71. 9	72. 7	1937	99. 7	86. 3	115. 5	111. 5
1910	48. 4	70. 4	68. 8	71. 3	1938	87. 4	78. 6	111. 2	115. 9
1911	47. 6	64. 9	73. 3	71. 9	1939	93. 2	77. 1	120. 9	121. 0
1912	50. 9	69. 1	73. 7	74. 8	1940	102. 9	78. 6	130. 9	130. 7
1913	54. 0	69. 8	77. 4	74. 8	1941	122. 5	87. 3	140. 3	135. 2
1914	49. 9	68. 1	73. 3	73. 6	1942	132. 8	98. 8	134. 4	137. 3
1915	48. 7	69. 5	70. 1	69. 3	1943	141. 4	103. 1	137. 1	139. 7
1916	55. 1	85. 5	64. 4	65. 3	1944	153. 3	104. 0	147. 4	143. 7
1917	72. 2	117. 5	61. 4	63. 1	1945	155. 1	105. 8	146. 6	147. 1
1918	83. 5	131. 3	63. 6	68. 8	1946	178. 4	121. 1	147. 3	158. 8
1919	113. 0	138. 6	81. 5	84. 0	1947	277. 6	152. 1	182. 5	173. 2
1920	165. 2	154. 4	107. 0	93. 2	1948	313. 0	165. 1	189. 6	185. 6
1921	88. 9	97. 6	91. 1	100. 2	1949	286. 0	155. 0	184. 5	192. 3
1922	99. 1	96. 7	102. 5	101. 6	1950	327. 4	161. 5	202. 7	194. 2
1923	111. 8	100. 6	111. 1	105. 0	1951	351. 4	179. 8	195. 4	198. 4
1924	99. 3	98. 1	101. 2	103. 2	1952	344. 4	174. 8	197. 0	196. 7
1925	100. 6	103. 5	97. 2	99. 5	1953	341. 0	172. 5	197. 7	196. 3
1926	100. 0	100. 0	100. 0	98. 3	1954	335. 2	172. 8	194. 0	----------
1927	93. 1	95. 4	97. 6	97. 1					

[1] U. S. Department of Labor, Bureau of Labor Statistics.

[2] Obtained by dividing annual lumber-price index by corresponding all-commodity price index.

of cement consumption is either noncompetitive or complementary in relation to lumber, a composite price in which Portland cement is weighted by total consumption would be biased.

Numerous other examples could readily be cited. Hence measurements of relative price on the basis of data now available may be roughly indicative, but this is about all that can be claimed for them. The relative price of lumber bears a strong resemblance to lumber's real price (table 243).

In general, price of lumber and price of all commodities maintained a fairly constant relationship from 1926 through 1933. From 1934 through 1950 price of lumber rose much more rapidly than price of all commodities, but from 1950 through 1954 they have maintained about the same relationship.

Table 243.—*Price of lumber in relation to price of certain materials in price competition with lumber, 1925–54*

[1926=100]

Year	Annual average price of lumber index	Annual average price of certain competing material [1]	Relative price of lumber	
			Index [2]	Index smoothed by 3-year moving average
1925	100.6	100.8	99.8	
1926	100.0	100.0	100.0	98.7
1927	93.1	96.7	96.3	96.7
1928	90.5	96.6	93.7	93.4
1929	93.8	103.9	90.3	89.8
1930	85.8	100.5	85.4	82.3
1931	69.5	97.6	71.2	73.6
1932	58.5	91.1	64.2	75.0
1933	70.7	78.8	89.7	84.0
1934	84.5	86.2	98.0	93.0
1935	81.8	89.6	91.3	95.9
1936	87.0	88.5	98.3	98.5
1937	99.7	94.1	106.0	99.6
1938	87.4	92.5	94.5	101.0
1939	93.2	90.9	102.5	104.2
1940	102.9	89.1	115.5	117.7
1941	122.5	90.6	135.2	131.4
1942	132.8	92.6	143.4	142.7
1943	141.4	94.5	149.6	152.4
1944	153.3	93.4	164.1	157.3
1945	155.1	98.0	158.3	164.0
1946	178.4	105.1	169.7	189.1
1947	277.6	116.0	239.3	217.9
1948	313.0	127.9	244.7	233.6
1949	286.0	132.0	216.7	233.5
1950	327.4	137.0	239.0	231.9
1951	351.4	146.4	240.0	238.2
1952	344.4	146.1	235.7	233.4
1953	341.0	151.9	224.5	224.6
1954	335.2	157.0	213.5	

[1] Includes Portland cement, concrete block, common building brick, light-colored facing brick, hollow building tile, structural steel, reinforcing steel bars, building sand, building gravel, crushed stone, insulating board, and Douglas-fir plywood. From 1947 on it includes steel window sash, rubber and asphalt tile, and asbestos-shingle siding.

[2] Obtained by dividing the lumber price index by the corresponding competing-materials price index.

The relation of lumber price to price of materials in direct competition with lumber appears to have been less stable. During the period 1926 through 1931, price of competing materials declined less than lumber price. Marketwise, lumber appears to have had a substantial price advantage by 1931, but the advantage waned quite rapidly and had disappeared entirely by 1937. From then until 1948 lumber price increased much faster than price of competing materials. But that progressive development of more and more disparity came to a halt in 1949. From then until 1954 the price disadvantage of lumber, marketwise, tended to lessen. Relative price of lumber and real price of lumber have been tending to converge as they had done in the early 1940's.

Real price is a better measure than relative price for three reasons. (a) Measurements of real price are the more reliable. (b) Real-price data are available for a longer period of time. (c) Since the rough data available indicate that relative price and real price have had a fairly strong resemblance during the period 1925–54, substitution of the one for the other would apparently not invalidate comparisons of long-term real-price trends against long-term consumption trends.

Relative Consumption Decreased 66 Percent, 1900–1954

During the period 1900 through 1952, population of the United States more than doubled and national economic output increased fourfold. Per capita consumption of goods and services in general has increased in accordance with rising standards of living, and this has involved a substantial increase in per capita consumption of basic raw materials. The relevant measure of lumber consumption is therefore not simply per capita lumber consumption but rather per capita lumber consumption in relation to per capita consumption of the cluster of materials which includes lumber and all materials that have been, or economically could have been, substituted for lumber.[136] Data on the trend in per capita

[136] Hypothetically, the volume of lumber consumed annually could have remained constant through this whole period with price continually rising. *Per capita* consumption of lumber, under such conditions, would have been declining. Less and less lumber would have been used per unit of economic output. Continuous decline in per capita lumber consumption is entirely consistent with concurrent rise in price of lumber. But the simple decline in per capita consumption of lumber does not indicate the full extent to which lumber has been displaced by substitute materials—nor does it indicate the full impact of price and nonprice factors on quantity of lumber consumed.

consumption of that particular cluster of materials are not available. However, lumber and its substitutes are widely used throughout the economy. It is reasonable to assume that per capita consumption of this cluster of materials has followed a trend roughly similar to the trend in per capita consumption of all the physical-structure materials, including lumber and all its substitutes.

The index of relative consumption of lumber, obtained by dividing index numbers of annual per capita consumption of lumber by the corresponding index numbers of per capita consumption of physical-structure materials, shows a decrease of 66 percent between 1900 and 1952 (table 244). Thus, the long-term upward progression of real price and of relative price of lumber has been matched by a long-term downward progression in relative consumption.

This broad generalization of the 52-year price-consumption relationship, however, does not hold for several of the shorter periods within that time span (fig. 118). During the 1900's and 1910's, for example, relative consumption of lumber was decreasing about as rapidly as at any time in the whole period. There had been a considerable rise in real price between 1904 and 1907, but from this latter year until 1917 real price was generally moving downward. From about the end of World War I until 1923, real price shot up more rapidly than at any other time during the 52-year period; but concurrent with this sharp price increase, there was also a moderate rise in relative consumption. From 1926 through 1932 real price remained almost constant, but relative consumption took a steep dive.

Throughout the last half of the 1930's and up to the end of the 1940's, real price climbed upward on a fairly steep and even grade. This upward trend came to a halt in 1952 and had not resumed again as of 1955. Relative consumption of lumber, on the other hand, has wavered both upward and downward but with considerable net decrease since the late 1930's. It leveled off in 1934–35, and then dropped—sharply in 1936 and moderately in 1937–38. Defense construction pulled lumber consumption upward again and held it about constant from 1939 through 1943. Wartime curtailment of all deferrable construction pushed it downward, moderately but steadily, from 1944 through 1948. The post-World War II construction boom raised consumption somewhat in 1949–52.

Past Consumption Decrease Chiefly Due to Real Price Increase

Tracing out these relationships of price to consumption shows that short-run variations in the quantity of lumber consumed are not direct and concurrent reflections of the rise and fall of lumber price. But the general relationship indicates that the increase of real price has

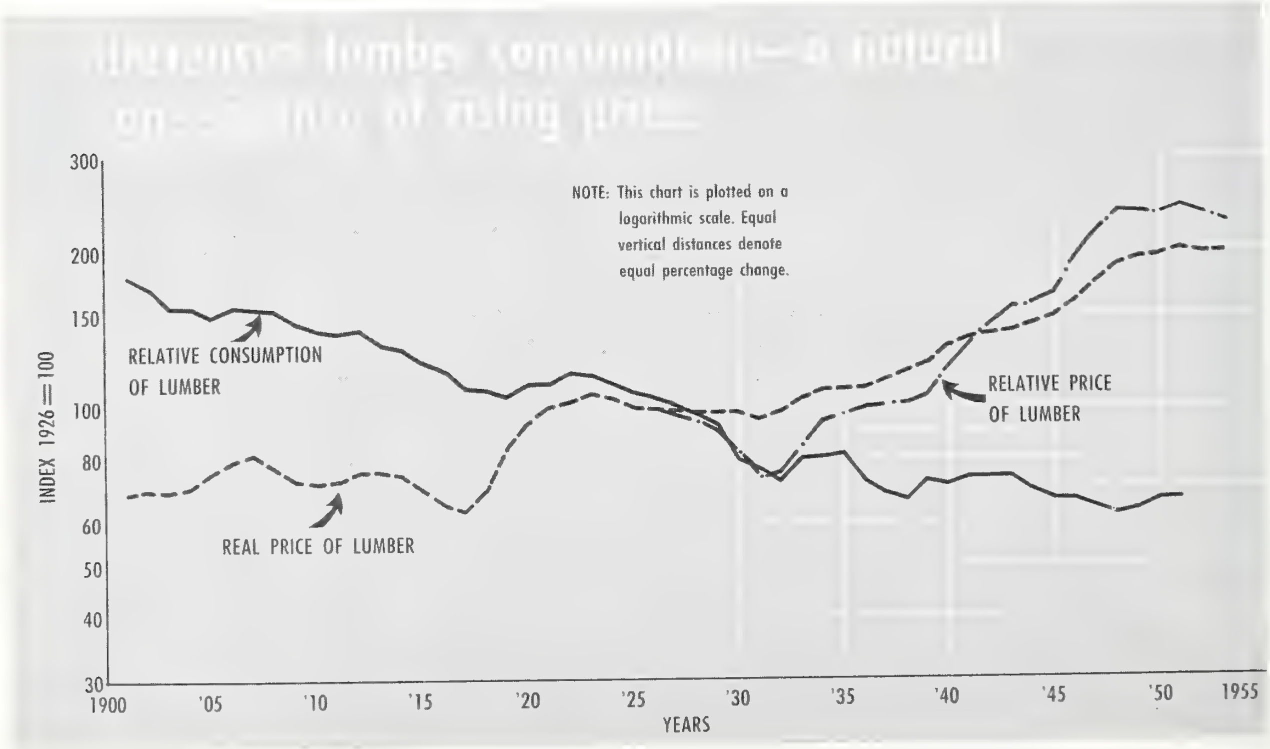


Figure 118

TABLE 244.—*Indexes of relative consumption of lumber, 1900–1952*

Year	Estimated consumption of lumber [1]	Per capita consumption of lumber		Per capita consumption of all physical-structure material		Relative consumption of lumber	
		Quantity	Index (1926=100)	Quantity [2]	Index (1926=100)	Index [3] (1926=100)	Index smoothed by 3-year moving average (1926=100)
	Billion bd.-ft.	*Board-feet*		*Billion units*			
1900	41	539	163	26	89	183	----------
1901	42	535	162	25	85	191	177
1902	42	530	161	30	103	157	171
1903	42	521	158	28	95	166	156
1904	42	505	153	30	104	147	155
1905	42	506	153	29	100	153	150
1906	45	527	160	31	106	151	156
1907	45	514	156	28	96	163	154
1908	41	460	139	27	94	148	153
1909	44	482	146	29	99	147	145
1910	43	470	142	30	102	139	141
1911	41	440	133	28	96	138	138
1912	43	453	137	29	99	138	139
1913	42	432	131	27	93	141	132
1914	39	390	118	29	100	118	128
1915	37	365	111	26	88	126	122
1916	40	389	118	28	96	123	117
1917	36	346	105	30	102	103	108
1918	32	306	93	28	94	99	107
1919	34	325	98	26	83	118	104
1920	35	325	98	30	104	94	110
1921	28	263	80	20	67	119	110
1922	35	317	96	24	81	118	116
1923	40	362	110	29	98	112	114
1924	38	337	102	27	92	111	110
1925	40	347	105	29	99	106	106
1926	39	330	100	29	100	100	103
1927	36	302	92	26	89	103	101
1928	38	313	95	28	94	101	97
1929	34	278	84	28	97	86	92
1930	30	244	74	24	82	90	80
1931	21	172	52	23	80	65	76
1932	17	139	42	16	56	74	72
1933	19	148	45	17	58	77	79
1934	18	140	42	14	50	85	80
1935	23	184	56	21	70	79	81
1936	26	200	61	23	78	79	72
1937	26	200	61	31	106	57	68
1938	24	182	55	23	80	69	66
1939	28	217	66	27	91	72	72
1940	34	260	79	31	104	76	71
1941	36	271	82	37	126	65	73
1942	44	325	98	37	127	77	73
1943	39	283	86	33	112	77	73
1944	35	250	76	34	116	65	69
1945	31	219	66	30	102	65	66
1946	34	237	72	31	106	68	66
1947	34	235	71	32	109	65	64
1948	36	248	75	38	128	58	62
1949	34	231	70	33	113	62	63
1950	41	270	82	34	117	70	66
1951	39	253	77	34	117	66	66
1952	42	264	80	38	130	62	----------

[1] Forest Service estimates.

[2] Constant-dollar quantity units at 1935–39 prices. U. S. Department of Commerce, Bureau of the Census. *Raw Materials in the United States Economy 1900–1952*, p. 60. Washington, D. C. 1954.

[3] Obtained by dividing index numbers for annual per capita consumption of lumber by corresponding index numbers for annual per capita consumption of all physical-structure materials.

probably been the major factor responsible for the decrease of relative consumption. The 1948–52 average real price of lumber was 93.8 percent above 1926, representing a 2.8 percent average increase per year. The corresponding decrease in relative consumption amounted to 36.7 percent, or 1.93 percent per year. The ratio of real-price increase to relative-consumption decrease for the period was thus approximately 2 to 1. In other words, a 2-percent increase in real price has been associated with a 1-percent decrease in relative consumption (fig. 119).

This ratio, of course, does not mean that price has affected consumption to just this extent. It

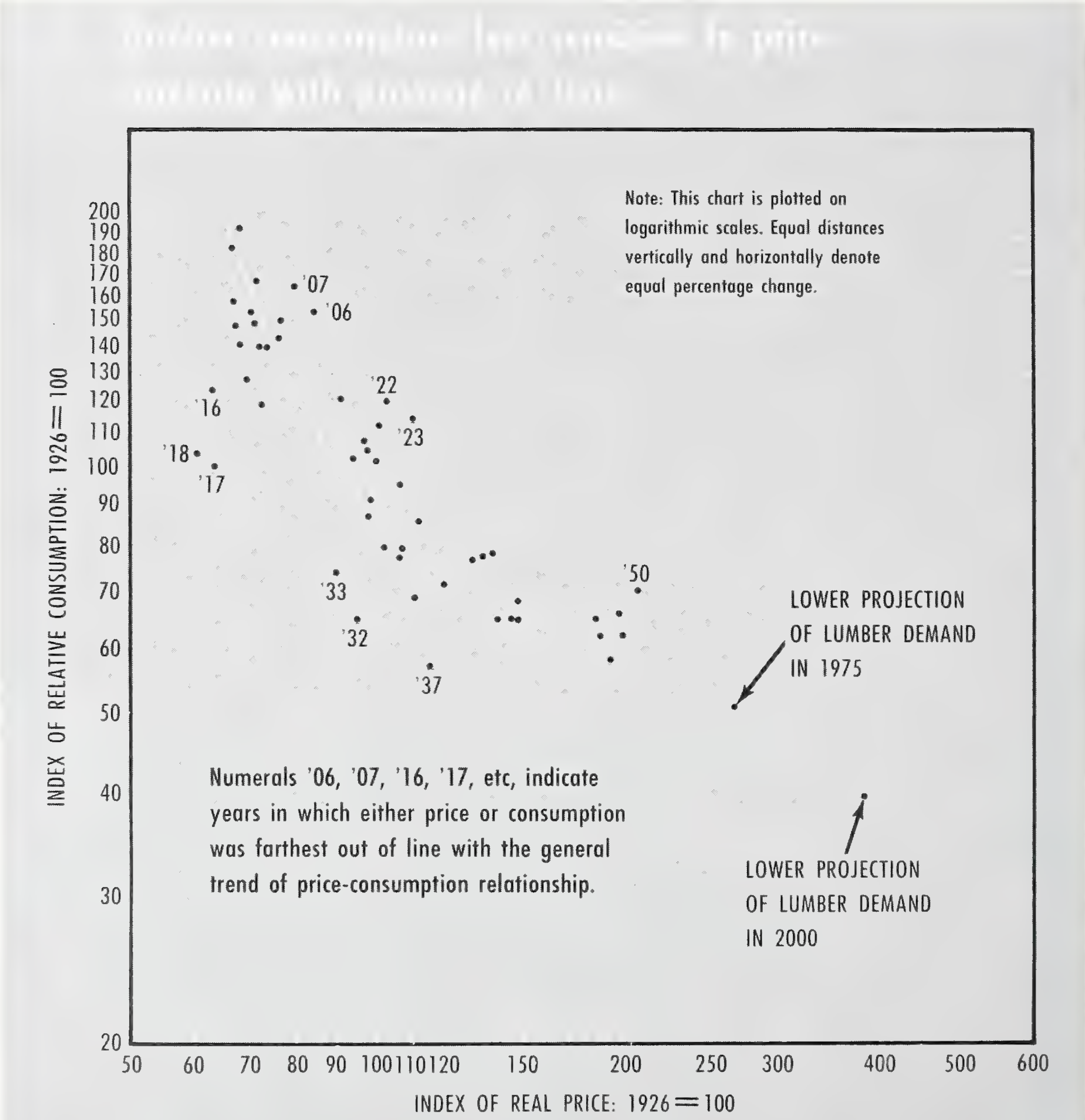


Figure 119

is quite possible that part of the decrease in consumption has been due to some deterioration in the quality of lumber, to the ways in which lumber has been marketed, to technological changes that have nothing to do with lumber as such, and to changes in consumer preference. Conversely, there are some indications that demand for lumber has become less sensitive to price-increase with the passage of time, possibly because (a) substitution of other materials for lumber has become progressively more difficult, technologically and economically, (b) important complementary relationships between lumber and other materials have been developing, (c) consumer preference for a material long in use tends to be stable, and (d) the efficiency of lumber marketing has improved. Unfortunately, there is no way to distinguish their impact from the impact of rising price.

But whatever the actual effects of these interacting influences have been, the experience of the past 20 years shows quite clearly that demand for lumber is no timid creature that retreats with every advance in price. Quite to the contrary, demand for lumber has displayed an amazing vigor and toughness in the face of advancing price.

Substantial Price Rise Assumed for Lower Projections

The lack of year-by-year information, on lumber consumption by principal end-uses, precludes analyses of the price-demand relationship on that basis. Therefore, the lower projection is made in terms of lumber demand for all uses. It is derived from the medium projection on the assumption that the 1926 to 1948–52 relationship between real price and relative consumption would continue to hold during the period 1948–52 through 1975 and from 1948–52 through 2000. Under this assumption, the real price of lumber would be expected to increase by 38 percent in the 1948–52 to 1975 period and by 97 percent in the 1948–52 to 2000 period (table 245). Consistent with these increases in real price, the lower projected demand for lumber in 1975 is estimated at about 48 billion board-feet and in 2000 at 55 billion, or 14 and 30 percent less, respectively, than medium projected demand.

These lower projections of lumber demand, of course, imply some pretty drastic losses of market to the lumber industry. In new residential construction, for example, average lumber use per dwelling unit would decline from 10,000 board-feet in 1952 to 7,700 in 1975 and to 6,200 board-feet by 2000. In new nonresidential construction, the reduction would be from 0.279 board-foot per dollar of expenditure in 1952 to 0.169 board-foot in 1975 and to 0.119 board-foot in 2000. Reductions in lumber use for residential and nonresidential maintenance and repair would be in like proportions. The railroads would have to get along in 1975 with no more lumber than they used in 1952,

TABLE 245.—*Relationship of lumber consumption to lumber price 1926 to 1948–52; lower projections to 1975 and 2000*

Item	Actual		Projections	
	1926	1948–52	1975	2000
Lumber consumption or projected demand:				
Total, billion board-feet	[1] 38. 8	[1] 38. 4	47. 6	54. 8
Per capita, board-feet	330. 0	253. 0	211. 0	199. 0
Index, 1926=100.0	100. 0	76. 7	67. 0	60. 3
Index, 1948–52=100.0	130. 4	100. 0	87. 4	78. 6
Physical-structure materials input per capita, units	[2] 29. 2	[2] 35. 4	38. 6	44. 4
Index, 1926=100.0	100. 0	121. 2	132. 2	152. 1
Index, 1948–52=100.0	82. 5	100. 0	109. 1	125. 5
Relative consumption of lumber:				
Index, 1926=100.0	[3] 100. 0	[3] 63. 3	50. 7	39. 6
Index, 1948–52=100.0	158. 0	100. 0	80. 1	62. 6
Average annual price of lumber:				
Index, 1926=100.0	[4] 100. 0	[4] 324. 4		
Real price of lumber:				
Index, 1926=100.0	[5] 100. 0	[5] 193. 8	267. 6	381. 0
Index, 1948–52=100.0	51. 6	100. 0	138. 1	196. 6

[1] Forest Service estimates.

[2] Quantity units measured in constant dollars at 1935–39 prices; Bureau of the Census, *Raw Materials in the United States Economy, 1900–1952*, p. 60. Washington, D. C., 1954.

[3] Obtained by dividing the index number for per capita consumption of lumber by the corresponding index number for per capita physical-structure materials input.

[4] U. S. Department of Labor, Bureau of Labor Statistics, Index of Wholesale Prices.

[5] Obtained by dividing the index number for lumber prices by the corresponding all-commodity price index number.

and with only a little more than that amount in 2000. Lumber use per dollar of expenditure for new farm service buildings would be down from the estimated 3.0 board-feet per dollar in 1952 to about 2.6 board-feet in 1975 and to 2.3 board-feet in 2000. Lumber use per dollar of household furniture shipments would have to decline much more than it has heretofore, and the same would be true for other manufactured products. There would also have to be some rather drastic curtailments of lumber use in shipping.

Summary of Lumber-Demand Projections

Medium projected demand for lumber in the United States is estimated at 55.5 billion board-feet in 1975 and about 79.0 billion in 2000 (table 246). These estimates assume a population of 215 million by 1975 and 275 million by 2000 and stability in the relative price of lumber and competing materials. But if the population should reach 360 million by 2000, and also assuming no change in relative prices, lumber demand may be about 90.0 billion board-feet.

If, on the other hand, population reaches the levels indicated above, but prices of lumber continue to rise considerably faster than prices of competing materials, lumber demand may be about 48.0 billion board-feet by 1975 and 55.0 billion by 2000. These lower projections are 14 and 30 percent less, respectively, than medium projected demand and reflect an assumed real-price increase of lumber of 35 to 40 percent during the period 1948–52 to 1975 and 90 to 100 percent by 2000.

In 1952, about 33.4 billion board-feet of softwood lumber were consumed and about 8.1 billion board-feet of hardwood. In general, the softwoods are preferred in all construction uses. Hardwoods are preferred for railroad ties, flooring, furniture, and many other manufactured products. For many end uses either softwood or hardwood lumber can be utilized. If past preferences continue, the distribution of future demand for softwood and hardwood lumber may be as follows:

	Million board-feet		
	Softwood	*Hardwood*	*Total*
Consumption in 1952	33, 408	8, 054	41, 462
Projections to 1975:			
Lower	36, 800	10, 800	47, 600
Medium	42, 400	13, 100	55, 500
Projections to 2000:			
Lower	41, 100	13, 700	54, 800
Medium	58, 900	20, 100	79, 000
Upper	67, 000	23, 000	90, 000

FUTURE DEMAND FOR PULPWOOD

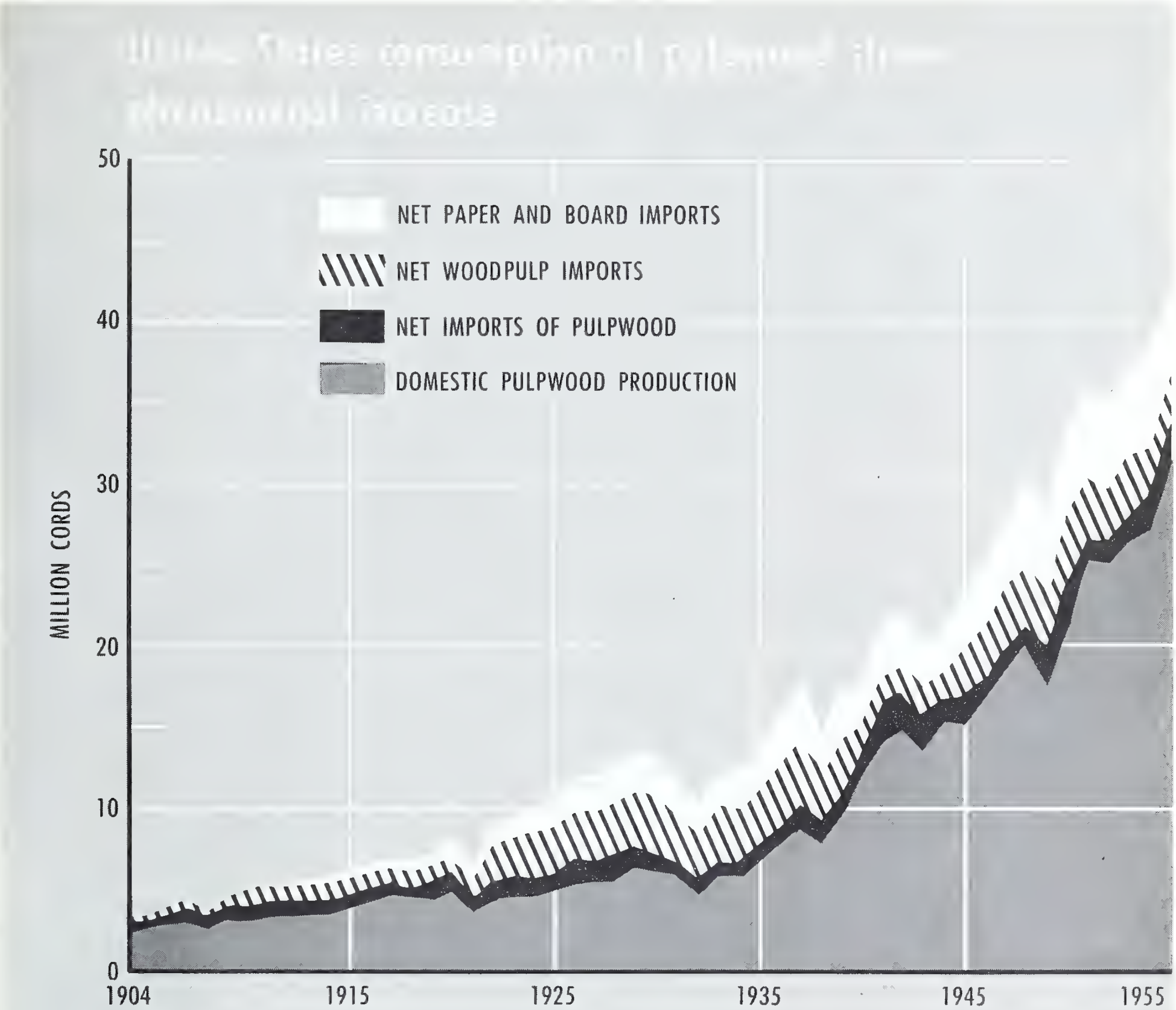
Pulpwood consumed during 1952 in the form of paper, paperboard, and nonpaper products of woodpulp (principally rayon fiber) accounted for about 27 percent of all industrial wood consumed in the United States. In 1900, it accounted for only about 2 percent of industrial-wood consumption. Pulpwood consumption (including wood equivalent of imported pulp and paper) has increased from about 2 million cords in 1900 to 35 million cords in 1952 and to 42 million cords in 1955 (table 247 and fig. 120).

Future demand for pulpwood is largely dependent upon future demand for paper, paperboard, and various nonpaper products of woodpulp (fig. 121). Demand for these end products, in turn, depends chiefly on whether population rises to 215 million in 1975 and 275 or 360 million in 2000 and whether gross national product rises to $630 billion in 1975 and $1,200 billion or $1,450 billion in 2000, in terms of 1953 dollars.

TABLE 246.—*Estimated consumption of lumber by specified end uses, 1952; projections of demand to 1975 and 2000*

[Million board-feet]

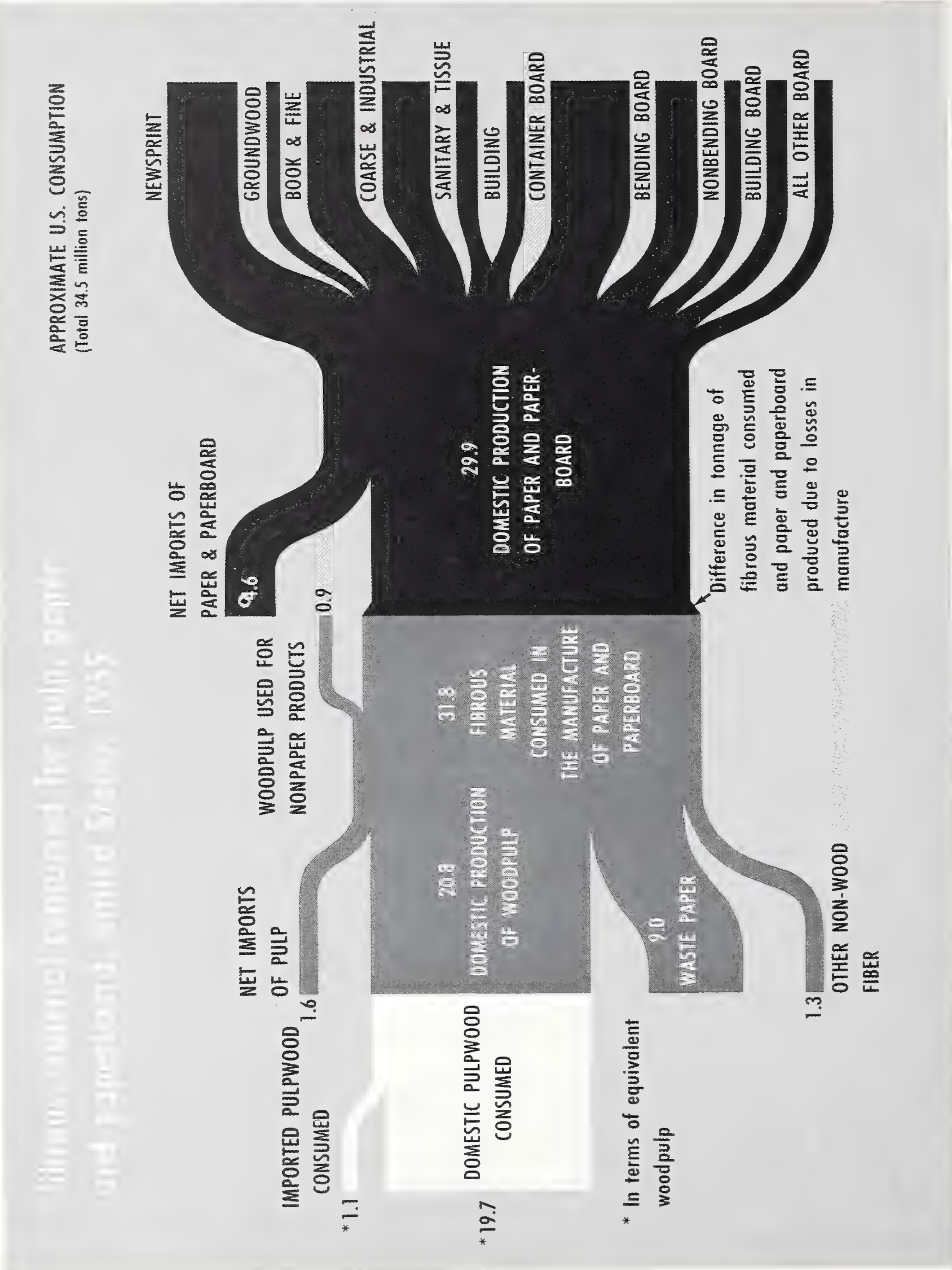
Use class	Estimated 1952 consumption	Projected 1975 demand		Projected 2000 demand		
		Lower	Medium	Lower	Medium	Upper
Construction:						
Residential, including farm	13, 010	15, 300	18, 000	15, 400	22, 000	26, 000
Nonresidential, excluding railroad and farm	5, 400	5, 900	7, 400	8, 000	13, 400	16, 000
Maintenance and repair	5, 700	6, 400	7, 600	8, 000	12, 200	13, 500
Railroad	2, 000	2, 000	2, 400	2, 300	2, 900	2, 900
Farm service buildings	4, 500	4, 800	5, 000	6, 000	7, 000	7, 400
Mining uses	780	800	900	1, 200	1, 500	1, 600
Total construction	31, 390	35, 200	41, 300	40, 900	59, 000	67, 600
Manufactured products	3, 950	5, 000	5, 500	6, 100	8, 000	9, 400
Shipping	6, 120	7, 400	8, 700	7, 800	12, 000	13, 000
Total end uses	41, 460	47, 600	55, 500	54, 800	79, 000	90, 000



Source: 1939 and 1941-1955—U.S. Department of Commerce, Bureau of the Census
1904-1938 and 1940—U.S. Department of Agriculture, Forest Service and American Paper and Pulp Association, STATISTICS OF PAPER, reporting statistics of the U.S. Department of Commerce, Bureau of the Census

Figure 120

The procedure is first to obtain estimates of total medium and upper demand for paper and paperboard under the various population and gross national product assumptions and the assumption that there will be no change in the prices of these products relative to the prices of competitive materials. The next step is to determine the quantity of woodpulp required to meet these demands and to estimate the quantity of woodpulp required for nonpaper products. Finally, the medium and upper projections of demand for pulpwood are derived directly from the estimates of demand for woodpulp. The lower projection of demand for pulpwood is approximated from the medium projection on the assumption of a substantial rise in relative price. No estimates are made of lower level demand for paper and paperboard, or of requirements for woodpulp.



APPROXIMATE U.S. CONSUMPTION
(Total 34.5 million tons)
NEWSPRINT
GROUNDWOOD
BOOK & FINE
COARSE & INDUSTRIAL
SANITARY & TISSUE
BUILDING
CONTAINER BOARD
BENDING BOARD
NONBENDING BOARD
BUILDING BOARD
ALL OTHER BOARD
NET IMPORTS OF PAPER & PAPERBOARD
4.6
29.9
DOMESTIC PRODUCTION OF PAPER AND PAPER-BOARD
Difference in tonnage of fibrous material consumed and paper and paperboard produced due to losses in manufacture
0.9
WOODPULP USED FOR NONPAPER PRODUCTS
31.8
FIBROUS MATERIAL CONSUMED IN THE MANUFACTURE OF PAPER AND PAPERBOARD
NET IMPORTS OF PULP
1.6
20.8
DOMESTIC PRODUCTION OF WOODPULP
9.0
WASTE PAPER
1.3
OTHER NON-WOOD FIBER
*1.1
IMPORTED PULPWOOD CONSUMED
*19.7
DOMESTIC PULPWOOD CONSUMED
* In terms of equivalent woodpulp

Figure 121

TABLE 247.—*Apparent consumption of pulpwood in the United States by source, selected years, 1899–1955*

[Thousand cords]

Year	Total [1]	Pulpwood logs and bolts			Pulpwood equivalents [2]		
		Domestic production	Net imports	Total [1]	Net wood-pulp import	Net paper and board imports	Total
1899	1, 966	1, 617	369	1, 986	56	[3] 76	[3] 20
1904	3, 242	2, 477	574	3, 051	261	[3] 70	191
1905	3, 375	2, 547	645	3, 192	265	[3] 82	183
1906	3, 866	2, 922	739	3, 661	310	[3] 105	205
1907	4, 321	3, 037	925	3, 963	442	[3] 84	358
1908	3, 674	2, 652	695	3, 347	370	[3] 43	327
1909	4, 547	3, 208	794	4, 002	560	[3] 15	545
1910	4, 874	3, 147	948	4, 094	773	7	780
1911	5, 181	3, 390	938	4, 328	857	[3] 4	853
1914	5, 795	3, 641	830	4, 471	1, 028	296	1, 324
1916	6, 656	4, 445	784	5, 229	997	430	1, 427
1917	6, 835	4, 706	774	5, 480	989	366	1, 355
1918	6, 566	4, 506	745	5, 251	862	453	1, 315
1919	6, 752	4, 446	1, 032	5, 478	924	350	1, 274
1920	8, 240	5, 015	1, 100	6, 114	1, 561	565	2, 126
1921	6, 621	3, 740	817	4, 557	1, 182	882	2, 064
1922	9, 022	4, 499	1, 050	5, 549	2, 219	1, 254	3, 473
1923	9, 957	4, 637	1, 236	5, 873	2, 406	1, 678	4, 084
1924	10, 194	4, 720	1, 048	5, 768	2, 714	1, 712	4, 426
1925	10, 778	5, 005	1, 088	6, 094	2, 899	1, 785	4, 684
1926	12, 106	5, 490	1, 277	6, 766	3, 067	2, 273	5, 340
1927	12, 206	5, 527	1, 224	6, 751	3, 010	2, 445	5, 455
1928	12, 928	5, 795	1, 366	7, 160	3, 154	2, 614	5, 768
1929	13, 989	6, 412	1, 233	7, 645	3, 348	2, 905	6, 253
1930	13, 188	6, 099	1, 096	7, 196	3, 238	2, 754	5, 992
1931	12, 075	5, 985	738	6, 723	2, 833	2, 519	5, 352
1932	10, 487	4, 891	742	5, 633	2, 643	2, 211	4, 854
1933	12, 240	5, 964	618	6, 582	3, 451	2, 208	5, 659
1934	12, 549	5, 980	817	6, 797	3, 073	2, 679	5, 752
1935	13, 810	6, 591	1, 037	7, 628	3, 252	2, 930	6, 182
1936	15, 966	7, 527	1, 189	8, 716	3, 838	3, 412	7, 250
1937	18, 286	8, 895	1, 499	10, 394	3, 823	4, 069	7, 892
1938	14, 902	7, 953	1, 241	9, 194	2, 928	2, 780	5, 708
1939	17, 387	9, 735	1, 081	10, 816	3, 452	3, 119	6, 571
1940	18, 026	12, 369	1, 374	13, 743	1, 306	2, 977	4, 283
1941	21, 450	14, 176	2, 208	16, 579	1, 473	3, 398	4, 871
1942	22, 259	14, 902	2, 158	17, 275	1, 524	3, 460	4, 984
1943	20, 455	13, 580	1, 676	15, 645	1, 793	3, 017	4, 810
1944	21, 150	15, 349	1, 630	16, 758	1, 543	2, 849	4, 392
1945	22, 976	15, 253	1, 688	16, 913	2, 971	2, 912	5, 883
1946	25, 127	16, 982	1, 942	17, 818	3, 220	4, 089	7, 309
1947	28, 318	18, 542	1, 998	19, 714	3, 972	4, 632	8, 604
1948	30, 297	20, 026	2, 268	21, 189	3, 789	5, 319	9, 108
1949	28, 464	17, 619	1, 639	19, 945	2, 973	5, 546	8, 519
1950	33, 659	20, 712	1, 807	23, 627	4, 158	5, 874	10, 032
1951	36, 158	25, 128	2, 637	26, 522	3, 875	5, 761	9, 636
1952	35, 419	25, 065	2, 293	26, 476	3, 105	5, 838	8, 943
1953	37, 773	26, 319	1, 537	28, 140	3, 583	6, 050	9, 633
1954	38, 056	26, 972	1, 583	29, 436	2, 850	5, 770	8, 620
1955	41, 923	30, 894	1, 868	33, 332	2, 755	5, 836	8, 591

[1] Includes changes in stocks for all years 1941 through 1955. Individual items may not add to total because of rounding.

Source: 1939 and 1941–55, U. S. Department of Commerce, Bureau of the Census. 1899–1938 and 1940, U. S. Department of Agriculture, Forest Service and American Paper and Pulp Association, *Statistics of Paper*, reporting statistics of the Bureau of the Census.

[2] Converting factors used were as follows:

Newsprint	1 ton=1.27 cords
Other paper	1 ton=1.50 cords
Paperboard	1 ton= .69 cords
Sulfite pulp	1 ton=2.05 cords
Sulfate pulp	1 ton=1.78 cords
Soda pulp	1 ton=2.10 cords
Groundwood pulp	1 ton=1.01 cords
Other pulp	1 ton=1.02 cords

[3] Net exports.

Paper and Paperboard

Between 1899 and 1955, per capita consumption of paper increased from 47 pounds to 233 pounds, or 396 percent.[137] During the same period, per capita consumption of paperboard increased from 11 pounds to 187 pounds, or 1,600 percent. The combined consumption of the two products exceeded 100 pounds per person by 1914, 200 pounds by 1930, and 300 pounds by the late 1940's; today it is well over 400 pounds per person.

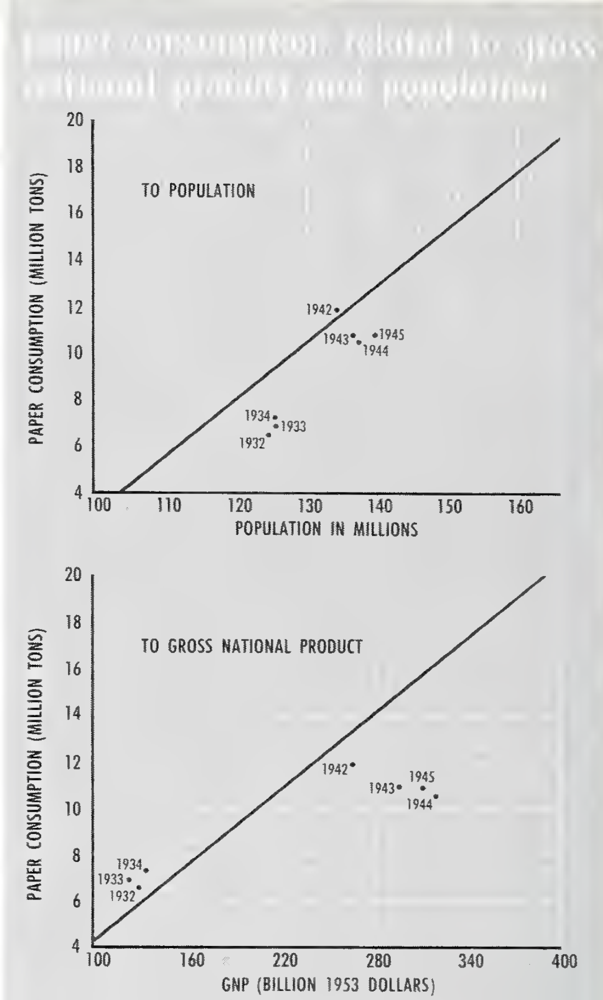
Paper Consumption Related to Gross National Product and Population

Paper is one of the most universally used materials in our economy. Apparent annual consumption has increased from about 1.8 million tons in 1899 to about 19.2 million tons in 1955, an increase of 982 percent in 56 years (table 248).

Thus it is not surprising that the trends in the consumption of paper bear a close relation to the trends in gross national product and population.[138] The two periods in which paper consumption departed from what appear to be its usual relations to gross national product and population were the depression years 1932–34 and the World War II years, 1942–45 (fig. 122).

The relationship of paper consumption to population and to gross national product during the period 1914–55 (but excluding 1932–34 and 1942–45) indicates that medium projected demand for paper may rise to 32.2 million tons by 1975 and to 55.0 million tons by 2000. Upper projected demand may rise to 70.0 million tons by 2000.

The medium and upper projections of total demand for paper in 1975 and 2000 conceal variations in consumption of the individual grade classes of paper. Yet these variations are important because woodpulp requirements differ from grade class to grade class. Hence, it is desirable to allocate the projections of total demand among demands for each of the grade classes of paper. Because trends will undoubtedly change and new grade classes will be developed, no attempt is made to break down the 2000 projections. However, the medium projection to 1975 is allocated by using, in most cases, the relation between trends in paper consumption and trends in gross national product and population, modified where appropriate by past trends in consumption of particular grade classes.



SOURCE: Paper; 1914-1938 and 1940-1941; American Paper and Pulp Association, STATISTICS OF PAPER, reporting statistics of the Bureau of the Census. 1939 and 1942-1955: U.S. Department of Commerce, Bureau of the Census. Gross National Product and Population: Joint Committee on the Economic Report, POTENTIAL ECONOMIC GROWTH OF THE UNITED STATES DURING THE NEXT DECADE, Washington, D. C., 1954.

Figure 122

Newsprint paper in the United States increased from 569 thousand tons consumed in 1899 to 6,500 thousand tons in 1955 (fig. 123). With the exception of the depression and wartime periods, about 98 percent of the annual variation in consumption has been associated with trends in gross national product and population. Based strictly on this past relationship, indicated medium demand in 1975 would amount to about 10.6 million tons. There is, however, some doubt that newsprint demand will continue to grow at the historical

[137] U. S. Pulp Producers Association. *Woodpulp Statistics*, pp. 106–110. 1956 ed., New York. (Compiled from data published by the U. S. Dept. Com.)

[138] Several analysts who have made estimates of long-term potential demand for paper have used disposable personal income (either by itself or in combination with population) as the independent factor in their projection equations. While the use of disposable personal income data for this purpose is not objectionable, its advantages are probably no greater than its disadvantages. Projections of gross national product are normally more reliable than projections of one component, such as disposable personal income.

TABLE 248.—*Apparent consumption of paper by principal grade classes in the United States, selected years, 1899–1955*

[Thousand tons]

Year	Newsprint [1]	Groundwood [2]	Book, fine, and absorbent [3]	Coarse and industrial [3]	Tissue and sanitary [3]	Building paper	Total [4]
1899	569	54	490	535	28	[2] 97	1, 773
1904	861	63	738	644	44	[2] 145	2, 469
1909	1, 119	100	887	763	78	[2] 226	3, 220
1914	1, 547	104	1, 163	911	115	[2] 244	4, 103
1917	1, 778	130	1, 221	844	146	[2] 300	4, 279
1918	1, 760	133	1, 267	891	150	[2] 311	4, 371
1919	1, 841	150	1, 380	858	190	[2] 195	4, 403
1920	2, 196	170	1, 576	1, 044	195	[2] 375	5, 376
1921	2, 013	92	1, 034	827	186	[2] 217	4, 309
1922	2, 451	150	1, 436	1, 048	215	419	5, 709
1923	2, 814	166	1, 611	1, 184	251	344	6, 389
1924	2, 821	170	1, 602	1, 235	242	348	6, 424
1925	2, 988	189	1, 808	1, 292	281	577	7, 118
1926	3, 516	209	1, 871	1, 420	310	645	7, 943
1927	3, 492	296	1, 949	1, 525	316	620	8, 171
1928	3, 561	235	2, 309	1, 467	348	560	8, 432
1929	3, 813	363	2, 264	1, 606	388	649	9, 108
1930	3, 496	221	2, 250	1, 581	362	460	8, 401
1931	3, 260	311	1, 828	1, 401	395	388	7, 625
1932	2, 831	125	1, 626	1, 244	359	290	6, 518
1933	2, 711	285	1, 726	1, 440	407	305	6, 943
1934	3, 177	154	1, 888	1, 356	397	325	7, 312
1935	3, 309	274	2, 015	1, 632	473	437	8, 175
1936	3, 675	199	2, 460	1, 879	495	546	9, 309
1937	4, 276	518	2, 328	2, 011	535	602	10, 350
1938	3, 101	436	2, 017	1, 820	543	564	8, 575
1939	3, 546	540	2, 431	2, 176	642	653	10, 005
1940	3, 775	550	2, 534	2, 352	721	677	10, 616
1941	3, 956	643	3, 022	2, 705	899	909	12, 132
1942	3, 749	610	2, 803	2, 605	974	995	11, 907
1943	3, 523	586	2, 644	2, 364	957	871	10, 852
1944	3, 200	593	2, 432	2, 462	955	876	10, 512
1945	3, 424	636	2, 503	2, 533	971	868	10, 847
1946	4, 200	776	3, 111	2, 841	1, 038	1, 028	13, 078
1947	4, 683	821	3, 409	3, 057	1, 081	1, 281	14, 448
1948	5, 160	772	3, 581	3, 229	1, 183	1, 314	15, 376
1949	5, 523	674	3, 338	2, 911	1, 186	1, 143	14, 788
1950	5, 856	705	3, 877	3, 545	1, 358	1, 419	16, 752
1951	5, 903	791	4, 167	3, 875	1, 466	1, 378	17, 692
1952	5, 943	806	3, 950	3, 480	1, 352	1, 293	16, 914
1953	6, 086	771	4, 164	3, 742	1, 484	1, 312	17, 622
1954	6, 082	808	4, 056	3, 902	1, 555	1, 348	17, 715
1955	6, 466	891	4, 385	4, 301	1, 679	1, 515	19, 180

[1] Includes changes in stocks for the years 1939 and 1942–55, inclusive.

[2] Production only.

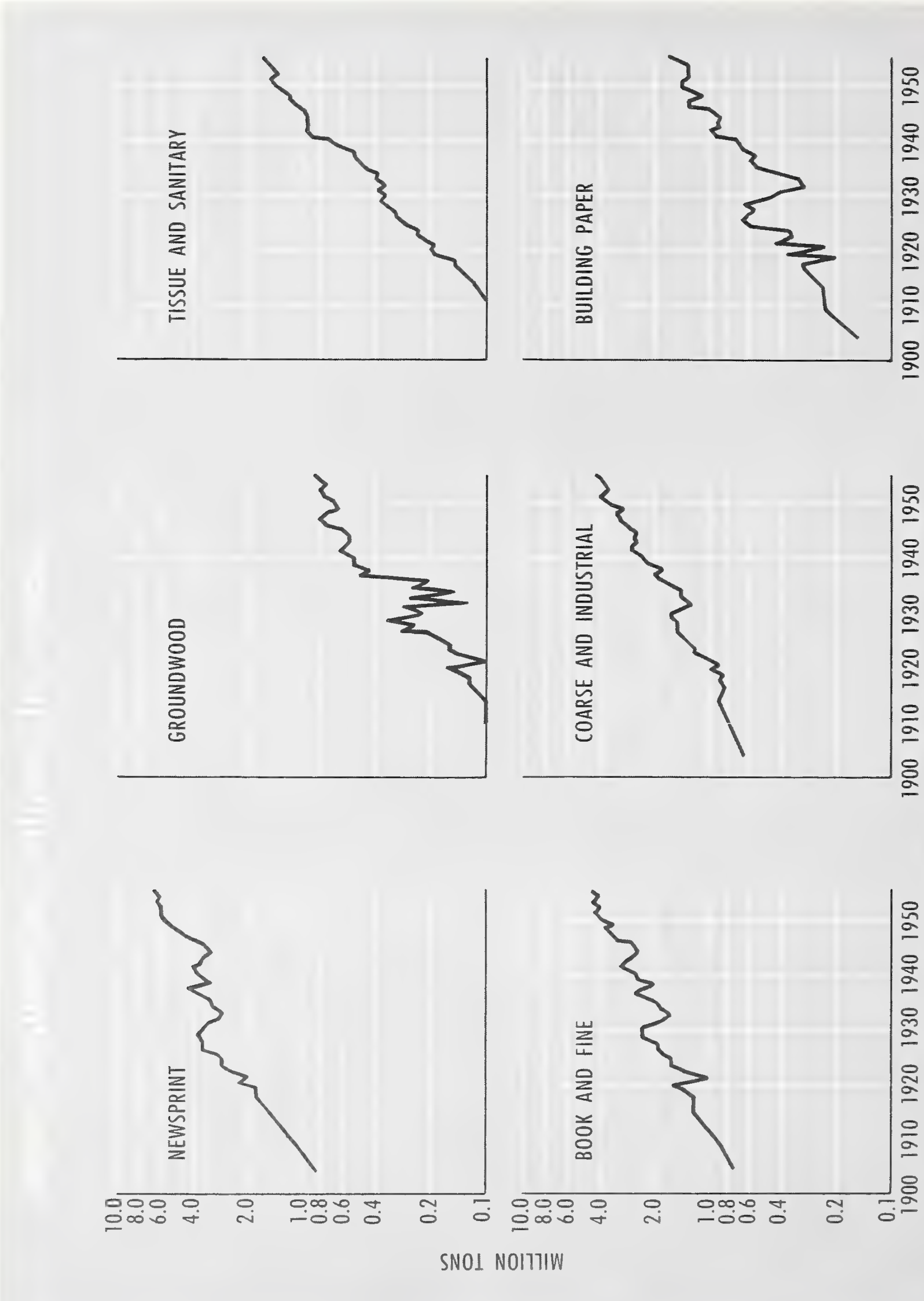
[3] Production only for years prior to 1937.

[4] Data for individual years may not add to total because of rounding, statistical discrepancies, the inclusion of stocks for some items, and the lack of import-export data for some classifications.

Source: 1899–1938 and 1940–41, American Paper and Pulp Association, *Statistics of Paper*, reporting statistics of the Bureau of the Census. 1939 and 1942–55, U. S. Department of Commerce, Bureau of the Census.

rate. Other advertising media have been offering strong competition, daily newspapers may be approaching the limit of practical size and the consumption of newspapers per inhabitant may be reaching a saturation point. Analysis of per capita consumption indicates that some slowing down in the rate of increase has occurred. These considerations appear to justify a lowering of the 1975 estimate of medium demand for newsprint to about 10.0 million tons. This represents an increase of 54 percent over 1955 consumption.

Groundwood paper—used for telephone directories, catalogues, wallpaper, mimeograph and business machine papers, scratch pads, and many



SOURCE: 1900-1938 and 1940-1941: American Paper and Pulp Association, STATISTICS OF PAPER, reporting statistics of the Bureau of the Census.
1939 and 1942-1955: U.S. Department of Commerce, Bureau of the Census.

Figure 123

other similar items—increased from 54 thousand tons consumed in 1899 to 891 thousand tons in 1955.[139]

Based on the past relationship of gross national product and population to consumption of groundwood papers, the indicated medium demand in 1975 would amount to 1.7 million tons. However, in the period 1937–55, with economic activity at a high level, groundwood paper consumption increased at a slower rate than prevailed in the period 1914–37. Hence, medium demand for groundwood paper in 1975 is estimated at 1.5 million tons. This represents an increase of 67 percent over 1955 consumption.

Book and fine papers include several hundred different grades, most of the paper used in printing magazines and books and the writing papers used in homes and offices. Consumption increased from about 490 thousand tons in 1899 to 4.4 million tons in 1955. Annual variation in consumption, 1914–55, has shown rather close correlations with changes in gross national product and population. Medium demand for book and fine papers in 1975 based on this past relationship is estimated at 7.5 million tons.

Coarse paper is used for brown paper bags and wrapping paper; industrial papers are used for punch cards, electrical material, file folders, and many other similar purposes. Consumption of coarse and industrial papers increased from 535 thousand tons in 1899 to 4,300 thousand tons in 1955. The trend in consumption has, in general, followed the trend in gross national product. Assuming the same relationship will be maintained, medium demand in 1975 is estimated at 7.4 million tons.

Tissue and sanitary papers increased from 28 thousand tons consumed in 1899 to 1.6 million tons in 1955. During the past 35 years consumption has increased much faster than population, personal income, gross national product, or any other independent variable commonly used in projecting demand. The extremely rapid rate of increase has been due to the development of many new uses and to vast improvements in the quality of products. Substitution of paper towels, napkins, and facial tissue for textiles has also contributed to increased consumption. It is believed, however, that the field for substitution has now been pretty well exploited and that future consumption of these grades of paper will tend to increase at a slower rate. Under this assumption, medium demand for tissue and sanitary papers in 1975 is estimated at 3 million tons, an increase of 88 percent over 1955 consumption.

[139] Available statistics are for production only. Exports and imports of this class of paper are relatively small. Production and consumption within the United States are approximately equal over a period of years, but not necessarily for any particular year.

Building paper includes sheathing papers, roofing felts, felts for asphalt tile, automotive felts, asbestos-filled paper, and a number of other items. Consumption of building paper increased from 97 thousand tons in 1899 to about 1.5 million tons in 1955. Demand for building paper depends in large part upon the amount of residential construction. If, as estimated previously, there is a 54 percent increase in residential construction by 1975, a medium demand for building paper of about 2.0 million tons is indicated. It is likely, however, that use of building paper will increase faster than residential construction activity, since new uses are still being developed. Assuming continued development of new uses for building paper, medium demand in 1975 is estimated at 2.8 million tons.

Paperboard Consumption Has Increased 5 Percent Annually Since 1929

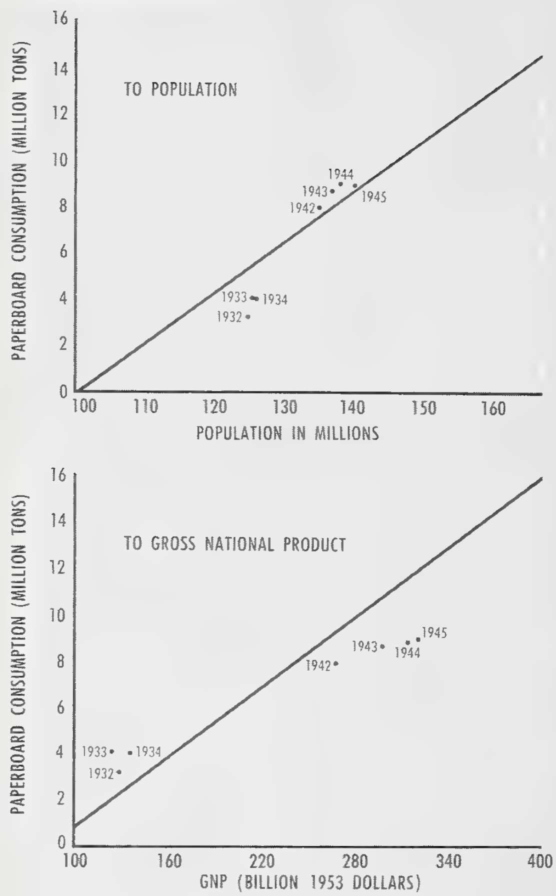
Apparent annual consumption of paperboard increased from about 394 thousand tons in 1899 to 15,341 thousand tons in 1955 (table 249). Prior to the 1920's, container board and bending board accounted for most of the paperboard consumed. Other grades were developed during the 1920's. During the period 1929–55 consumption of paperboard increased at an average annual rate of 5 percent. (The corresponding rate of increase of consumption for paper during the same period was 2.9 percent.)

Paperboard consumption has been closely related to gross national product and population during the period 1914 through 1955 (fig. 124). Consumption of paperboard fell less than gross national product during the depression years 1932–34. During the war years (1942–45) it maintained a closer relationship to gross national product than paper, but there was some lag. With respect to population, there was no substantial deviation from the regression line during that period.

Assuming as in the case of paper that this relationship will continue into the future and that gross national product and population will increase as estimated, medium projected demand for paperboard is expected to reach 27.8 million tons by 1975 and 50.0 million by 2000. Upper projected demand totals 65.0 million tons in 2000.

As in the case of paper, allocation of the total demand for paperboard, by principal grade classes, is made only for medium projected demand in 1975, using the relationships between trends in consumption and in gross national product and population. No grade class allocation is made for the 2000 projections.

Container board, ordinarily used for the outer packing box or case in the shipment of commodities, includes liners, corrugating material, and container chipboard. Consumption has in-



SOURCE: Paperboard; 1914-1938 and 1940-1941; American Paper and Pulp Association, STATISTICS OF PAPER, reporting statistics of the Bureau of the Census. 1939 and 1942-1955: U.S. Department of Commerce, Bureau of the Census. Gross National Product and Population: Joint Committee on the Economic Report, POTENTIAL ECONOMIC GROWTH OF THE UNITED STATES DURING THE NEXT DECADE, Washington, D. C., 1954.

Figure 124

creased from about 1.8 million tons in 1925, to 7.3 million tons in 1955 (fig. 125), somewhat faster than gross national product and population. Indicated demand for container board in 1975, on the basis of that relationship, is estimated at 12.9 million tons. However, a large part of the displacement of nailed wooden boxes by fiber packing cases and cartons has already occurred, and consumption may not continue to increase quite as rapidly in the future. On the other hand, there is the definite possibility that container board capable of withstanding high humidity and water condensation will be perfected and become available at low cost, with consequent increases in demand.

With consideration of the above factors, medium demand for container board in 1975 is estimated at 12.5 million tons, 71 percent above 1955 consumption.

Bending board, one of the newer paperboard products, is used largely for cereal boxes, frozen food wrappers, milk cartons, toothpaste tube boxes and hundreds of similar packages for consumer goods. Consumption increased from 796 thousand tons in 1927 to 3.9 million tons in 1955. If the consumption of bending board continues to maintain its relationship with gross national product and population, medium demand in 1975 may amount to 7.5 million tons, an increase of 92 percent over consumption in 1955.

Nonbending board, one of the older paperboard products, is typically used for shoe boxes, hat boxes, filing boxes, and book covers. Consumption increased from 444 thousand tons in 1927 to 1.0 million tons in 1955. The trend has been different from the trend in consumption of other classes of paperboard, principally because of displacement by bending board in a number of important uses.[140] In the past, there has been very little relation between consumption of nonbending board and changes in gross national product and population. However, with respect to many uses, displacement of nonbending board by other types of board does not seem likely and a moderate increase in demand can be reasonably anticipated. The estimate of medium demand is 1.5 million tons in 1975 or 50 percent above the level of consumption in 1955.

Building board, in Census paperboard statistics, includes a variety of products ranging from very low density acoustical tile to high density hardboards.[141] Because the mix of these products has

[140] Bending board containers are shipped to user flattened out and require less protection in shipment and occupy less storage space. The box made of nonbending board is normally set up before shipment to the user, and such shipments are bulky, require rigid packing cases and occupy a considerable amount of storage space. Yet, for a number of uses, the disadvantages associated with nonbending board cannot very well be avoided. Hats, for instance, require a rigid package to keep them from being crushed out of shape.

[141] Resin-bonded particle board—another type of sheet material—is ordinarily manufactured by pressing a blend of wood particles and thermosetting resins in multiplaten hot presses or by forcing the material through an extrusion press. It is adaptable for many uses in construction and fabricated products as a substitute for lumber and plywood and is used interchangeably with conventional hardboard. It is a relatively new product developed almost entirely since 1948. While the annual productive capacity of the industry in 1956 was estimated in excess of 700 million square feet, ⅜ inch basis, no data on actual production exist. Because it is produced from residues from other wood-using plants at some relative cost advantage over competing materials, and technological improvements in the product may possibly open new fields of use, the demand for particle board, as for other sheet materials, is expected to grow rapidly in the years ahead.

TABLE 249.—*Apparent annual consumption of paperboard by principal grade classes in the United States, selected years, 1899–1955*

[Thousand tons]

Year	Container board [1]	Bending board [2]	Nonbending board [2]	Building board	Other paperboard [3]	Total [4]	Total paper and paperboard [4]
1899						394	2,168
1904						560	3,029
1909						883	4,103
1914						1,292	5,395
1917						1,775	6,054
1918						1,904	6,275
1919						1,850	6,253
1920						2,264	7,640
1921						1,718	6,027
1922						2,156	7,865
1923						2,805	9,194
1924						2,857	9,281
1925	1,777			83		3,299	10,417
1926				102		3,641	11,584
1927	2,100	796	444	81	333	3,754	11,925
1928	1,985	948	621	80	385	4,019	12,451
1929	2,256	991	600	137	319	4,303	13,411
1930	1,915	1,013	653	108	229	3,918	12,319
1931	1,904	906	562	107	250	3,729	11,354
1932	1,592	887	465	65	207	3,216	9,734
1933	2,021	958	572	47	375	3,973	10,916
1934	1,882	966	591	59	479	3,977	11,289
1935	2,358	1,121	624	65	415	4,583	12,758
1936	2,756	1,272	701	88	525	5,342	14,651
1937	3,168	1,289	720	98	403	5,678	16,028
1938	2,631	1,221	609	109	397	4,967	13,542
1939	3,318	1,360	865	102	299	5,944	15,949
1940	3,334	1,416	899	163	329	6,141	16,757
1941	4,149	1,842	1,239	623	436	8,289	20,421
1942	3,712	1,712	997	882	570	7,873	19,780
1943	4,065	2,047	829	907	737	8,585	19,437
1944	4,197	2,116	750	936	934	8,933	19,445
1945	4,093	2,270	721	890	886	8,818	19,665
1946	4,291	2,708	603	977	903	9,432	22,510
1947	4,896	2,758	705	1,064	930	10,313	24,761
1948	5,029	2,672	702	1,266	1,056	10,706	26,082
1949	4,630	2,613	753	837	1,081	9,906	24,694
1950	5,770	3,135	876	1,227	1,249	12,259	29,011
1951	6,188	3,272	877	1,276	1,297	12,873	30,565
1952	5,673	3,144	783	1,315	1,217	12,109	29,022
1953	6,629	3,567	957	1,379	1,336	13,736	31,358
1954	6,284	3,525	926	1,513	1,337	13,521	31,235
1955	7,355	3,931	1,029	1,662	1,546	15,341	34,521

[1] Production only for years prior to 1937.
[2] Production only.
[3] Production only for the years 1945–55. All other years represent a residual between the sum of the columns for other types of paperboard and total paperboard consumption.
[4] Data for individual years may not add to total because of rounding, statistical discrepancies, the inclusion of stocks for some items, and the lack of import-export data for some classifications.

Source: 1899–1938 and 1940–41, American Paper and Pulp Association, *Statistics of Paper*, reporting statistics of the Bureau of the Census. 1939 and 1942–55, U. S. Department of Commerce, Bureau of the Census.

changed quite radically in recent years, interpretation of the statistics is rather difficult.[142] Consumption of hardboard having a density of more than 26 pounds per cubic foot increased from 216 million square feet (⅛-inch basis) in 1939 to 1,226 million square feet in 1953.[143] The 1953 output

[142] The historical series measures building board consumption on a tonnage basis. The high-density hardboards, produced in rapidly increasing quantities since the early 1940's, greatly outweigh other types of building board on a cubic-foot or square-foot basis and introduce a bias in the total tonnage figure which limits their significance. Thus tonnage data tend to overstate the increase in consumption of hardboard and understate increases in consumption of the low density insulation boards.

[143] U. S. Tariff Commission, *Hardboard Report on Investigation Conducted Pursuant to Resolution by Senate Committee on Finance*, p. 34. August 9, 1954. Washington, D. C. 1955; and Bureau of the Census, *Facts for Industry, Pulp, Paper and Board Summary for 1953.* Washington, D. C. 1954.

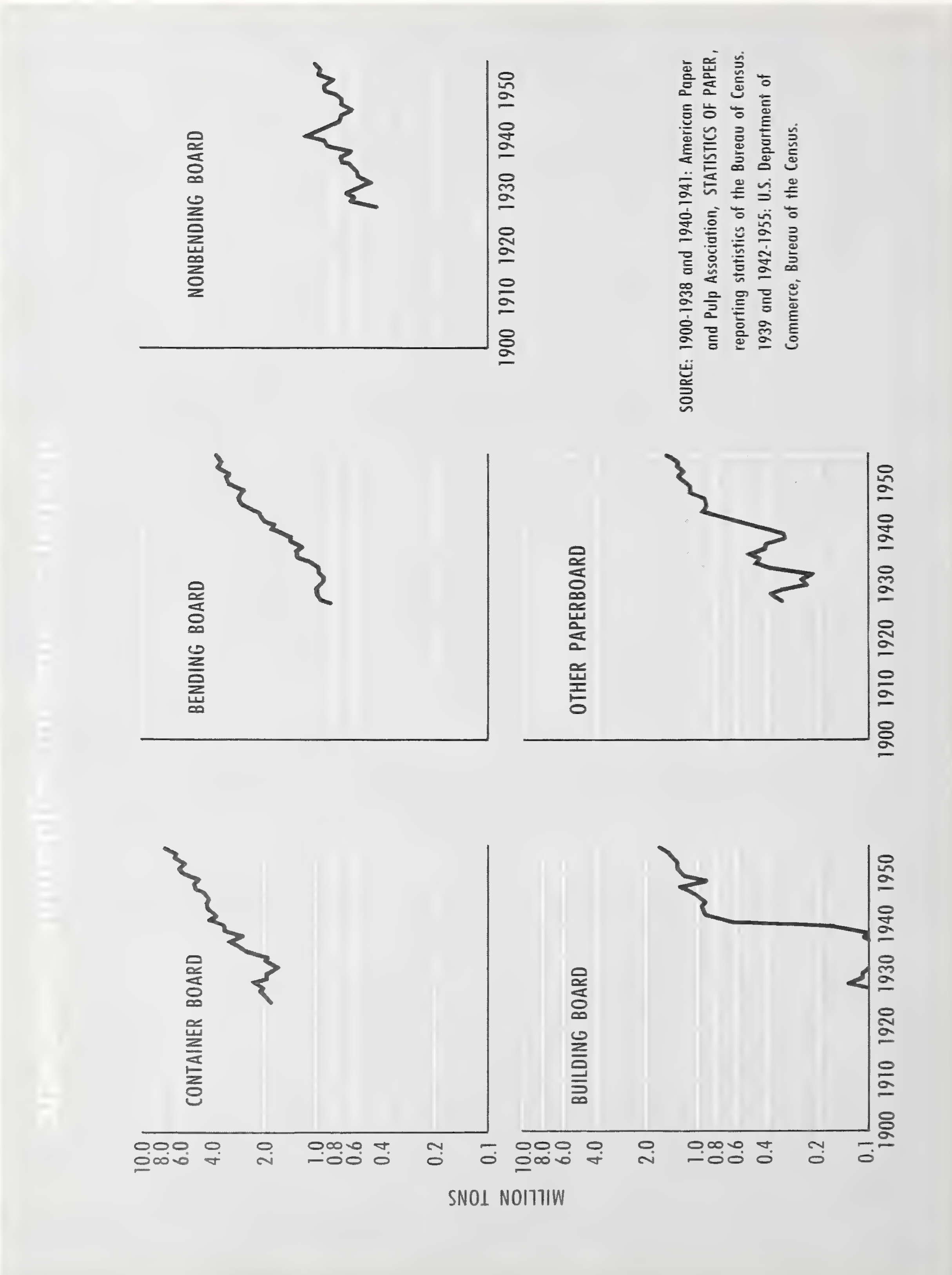

MILLION TONS
10.0
8.0
6.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
CONTAINER BOARD
BUILDING BOARD
BENDING BOARD
OTHER PAPERBOARD
NONBENDING BOARD
1900 1910 1920 1930 1940 1950
SOURCE: 1900-1938 and 1940-1941: American Paper and Pulp Association, STATISTICS OF PAPER, reporting statistics of the Bureau of Census. 1939 and 1942-1955: U.S. Department of Commerce, Bureau of the Census.

Figure 125

amounted to 423 thousand tons or about one-third of 1953 building board consumption. The past decade, however, has been a developmental period stimulated in part by the expiration of certain patents, formerly held by one company. Comparable annual percentage increases in consumption are not likely to continue indefinitely, even though most of the increase in the consumption of building board since 1940 has been accounted for by the rapid increase in hardboard production. It is expected that building board will continue to displace lumber and plywood in construction and that medium demand by 1975 may total 3.5 million tons.

Other paperboard includes products such as stock used for fiber tubes, drums and cans, eggcase filler board, liners for gypsum and plaster board, cardboard, and a number of other items. Consumption increased from 319 thousand tons in 1929 to 1,500 thousand tons in 1955, substantially above increases in gross national product and population. About half of the past consumption of other paperboard appears to have been associated with construction and half with shipping. Some increase in the use of other paperboard as a substitute for lumber and plywood in construction and in shipping is expected. Medium demand in 1975 is estimated at 2.8 million tons, about 87 percent above the level of 1955 consumption.

Woodpulp

The total estimates of medium and upper demand for paper and paperboard indicate that per capita consumption may increase from 420 pounds in 1955 to 558 pounds in 1975 and to 750 pounds or more in 2000. The next step is to estimate the amount of new woodpulp that would be required to meet the medium demand for 60 million tons of paper and paperboard in 1975 and 105 million tons in 2000 or the upper demand of 135 million tons in 2000 (table 250). Additional allowance must also be made for woodpulp required in the manufacture of nonpaper products.

Once suitable pulping processes were developed, wood rapidly assumed the dominant position as a source of fiber for the paper industry. As early as 1899, 53 percent of all fibrous materials used in the manufacture of paper and paperboard consisted of new woodpulp. Since then, the relative importance of new woodpulp has increased and in 1955 it accounted for about 68 percent of all raw material used. Waste paper (largely made originally from woodpulp) has been the second most important source and in 1955 accounted for about 28 percent of fibrous materials consumed. Rags, straw, bagasse, cotton, manila stock, and other materials of miscellaneous origin contributed small amounts of fiber—about 4 percent of the total in 1955. A large part of these miscellaneous fibers were used in the manufacture of specialty products.

TABLE 250.—*Consumption of paper and paperboard in the United States, 1955; medium and upper projections of demand to 1975 and 2000*

[Million tons]

Grade classes	1955 consumption [1]	Medium projected demand 1975	Medium projected demand [2] 2000	Upper projected demand [2] 2000
Paper:				
Newsprint	6. 5	10. 0		
Groundwood papers	. 9	1. 5		
Book and fine	4. 4	7. 5		
Coarse and industrial	4. 3	7. 4		
Tissue and sanitary	1. 6	3. 0		
Building paper	1. 5	2. 8		
All papers	19. 2	32. 2	55. 0	70. 0
Index	100	168	286	365
Paperboard:				
Container board	7. 3	12. 5		
Bending board	3. 9	7. 5		
Nonbending board	1. 0	1. 5		
Building board	1. 6	3. 5		
Other boards	1. 5	2. 8		
All paperboard	15. 3	27. 8	50. 0	65. 0
Index	100	182	327	425
All paper and paperboard	34. 5	60. 0	105. 0	135. 0
Index	100	174	304	391

[1] U. S. Department of Commerce, Bureau of the Census.
[2] Not itemized by grade classes.

Since 1929, the quantity of new woodpulp consumed per ton of paper and paperboard produced has increased gradually (although with considerable variations), climbing from 0.60 ton in that year to the 1954 level of 0.71 ton. Because the quantity varies widely from one grade class to another, it is desirable to estimate demand for new woodpulp separately by grade classes of paper and paperboard, where possible. Since 1943–44 there has been a shift toward more new woodpulp in most grades of paper and paperboard (table 251).

Medium and upper estimates of requirements for new woodpulp to be used in the manufacture of paper and paperboard are based upon the 1954 factors, but with adjustments to take into account expected trends in new woodpulp content in the principal grade classes of paper and paperboard. For 1975 the medium estimate of woodpulp

TABLE 251.—*Quantity of new woodpulp consumed per ton of paper and paperboard output, 1943–44, 1947, and 1954*

Grade class	Tons of pulp per ton of output		
	1943–44	1947	1954
Paper:			
Newsprint	1. 05	[1] 1. 01	1. 08
Groundwood papers	. 89	1. 01	. 97
Book and fine	. 67	. 74	. 81
Coarse and industrial	. 98	1. 00	. 98
Tissue and sanitary	. 95	. 94	. 90
Building paper	. 19	. 28	. 32
All paper	. 80	. 83	. 86
Paperboard:			
Container board	. 55	. 56	. 79
Bending board	. 25	. 24	. 40
Nonbending board	. 01	. 02	[2]
Building board	. 63	. 80	. 79
Other board	. 24	. 18	. 10
All paperboard	. 42	. 43	. 57
All paper and board	. 60	. 63	. 71

[1] Average for newsprint and groundwood papers combined.
[2] No data available.

Source: 1943–44, U. S. War Production Board, unpublished Memo. No. WPBJ 2622, 12/19; 1947 and 1954, Bureau of the Census, *Census of Manufactures.*

requirements (excluding requirements for nonpaper uses) totals about 47 million tons:

	Million tons
Paper:	
Newsprint	10. 7
Groundwood	1. 5
Book and fine	6. 3
Coarse and industrial	7. 5
Tissue and sanitary	2. 7
Building paper	1. 1
All paper	29. 8
Paperboard:	
Container board	10. 6
Bending board	3. 8
Nonbending board	. 1
Building board	2. 8
Other paperboard	. 3
All paperboard	17. 6
Total paper and paperboard	47. 4

By the year 2000 the use of new woodpulp per ton of paper and paperboard produced is expected to decrease from the average assumed for 1975 (0.79 ton of pulp per ton of paper and paperboard produced). If this happens, the medium level of paper and paperboard requirements for new woodpulp will probably be in the neighborhood of 72 million tons, and the upper estimate would be 91 million tons. (Neither of these estimates includes nonpaper requirements for woodpulp.)

Future Requirements Vary by Type of Woodpulp

There are 5 major types of woodpulp used in the manufacture of paper and paperboard: Groundwood, sulfite, sulfate, soda, and semichemical and other.[144] Each of these has special characteristics that make it desirable for use in the manufacture of specific grade classes of paper and paperboard (table 252). They are to some extent interchangeable, however, and nearly all grade classes of paper and paperboard can be manufactured from pulp furnishes consisting of widely varying proportions of the different types of pulp.

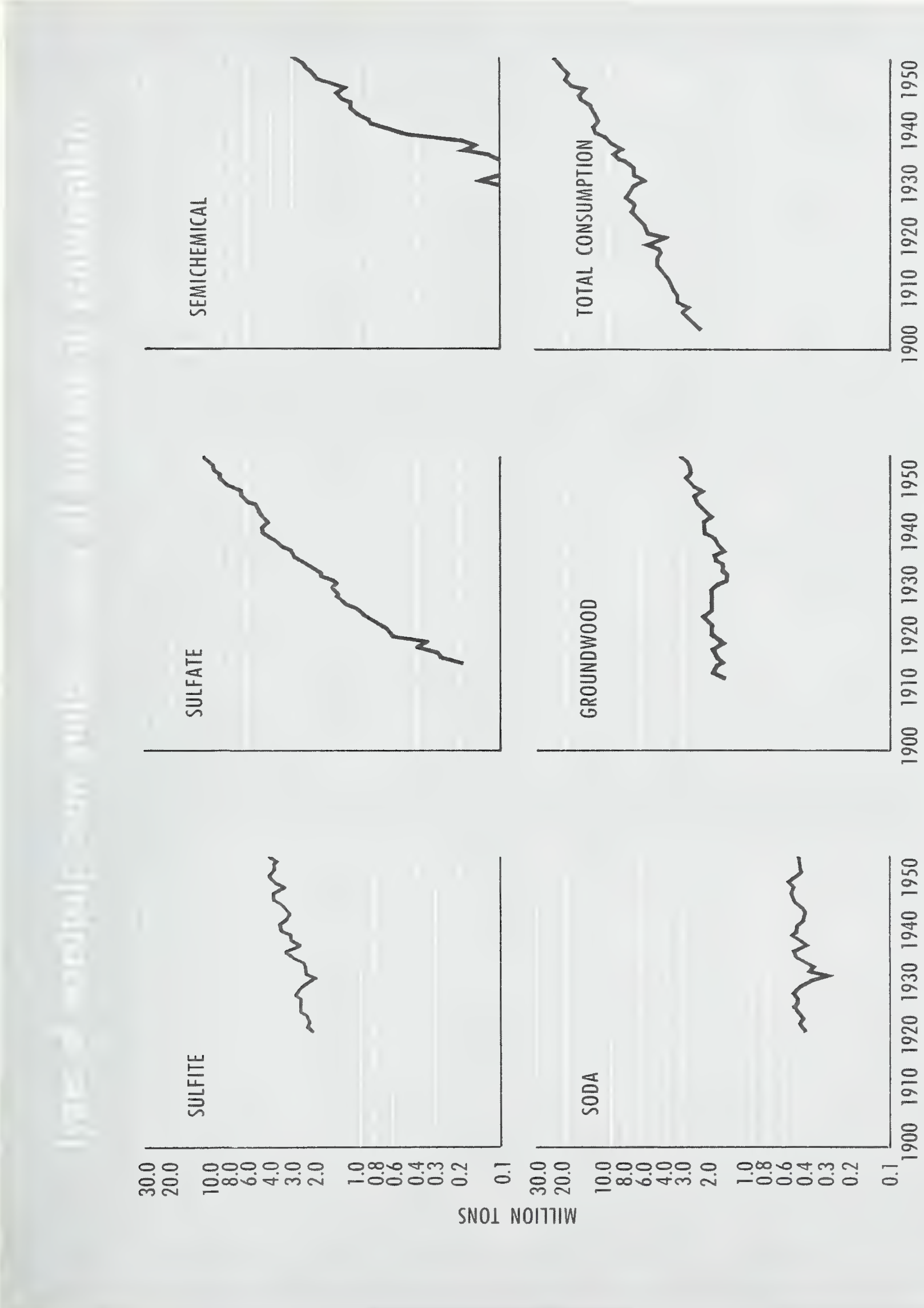
There has been a tendency for the sulfate and semichemical pulps to replace soda, sulfite, and groundwood pulps (table 253 and fig. 126). Changes in consumption during the period 1940 to 1955 have been as follows:

Type:	*For the period (percent)*	*Average annual (percent)*
Groundwood	+64	+3. 4
Sulfite	+37	+2. 1
Sulfate	+208	+7. 8
Soda	−10	−0. 7
Semichemical and other	+546	+13. 2
Total all pulps	+131	+5. 7

The technology of paper manufacture now permits a wider range in substitution between types of pulp than ever before. Furthermore, both the sulfate and the semichemical processes are adaptable to the pulping of a wide range of species including hardwoods and resinous softwoods, which are in greater supply than spruce, fir, and hemlock—the preferred species in the past. Higher yields per cord of wood processed and lower production costs have also given a price advantage to the sulfate and semichemical pulps. Moreover, stream pollution identified with the sulfite process has hindered expansion of sulfite-mill capacity. As a result, most of the new mills constructed recently in the United States have been designed for either the sulfate or one of the semichemical processes. This trend is expected to continue in the future as competition increases for the available supplies of softwood timber, as pollution problems become more acute, and as further efforts are made to hold down costs.

No attempt is made to allocate the woodpulp estimates for 2000 by type. However, consideration of the above trends provides a basis for estimating requirements for the various types of new woodpulp that comprise the medium estimate for 1975. These requirements, by type of pulp, are

[144] These include semichemical, chemi-groundwood, defibrated, exploded, and other miscellaneous types of pulp



SOURCE: 1900-1938 and 1940-1941: United States Pulp Producers Association, WOODPULP STATISTICS, reporting statistics of the Bureau of the Census. 1939 and 1942-55: U.S. Department of Commerce, Bureau of the Census.

Figure 126

TABLE 252.—*Type distribution of new woodpulp used in manufacture of various grade classes of paper and paperboard, 1947 and 1954*

Grade class and year	New woodpulp content by type					
	Groundwood	Sulfite	Sulfate	Soda	Semichemical and others	Total
Paper:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Newsprint,[1] 1954	81	10	9	0	0	100
Groundwood,[1] 1954	66	27	7	0	0	100
Book and fine:						
1947	6	53	21	19	0	100
1954	8	37	40	13	2	100
Tissue and sanitary:						
1947	21	66	13	0	0	100
1954	15	54	30	0	1	100
Coarse and industrial:						
1947	1	17	80	0	2	100
1954	0	12	86	0	2	100
Building paper:						
1947	13	0	2	0	85	100
1954	8	3	0	0	89	100
Paperboard:						
Container:						
1947	2	0	81	0	17	100
1954	1	0	80	0	19	100
Bending board,[2] 1947	18	32	46	1	3	100
Nonbending board,[2] 1947	39	37	13	0	11	100
Building board:						
1947	47	0	0	0	53	100
1954	40	0	0	0	60	100
Other paperboard:						
1947	33	16	38	3	10	100
1954	31	23	29	0	17	100

[1] The 1947 Census of Manufactures grouped newsprint and groundwood papers together.

[2] Data on types of woodpulp used in 1954 not available.

Source: *Census of Manufactures*, 1947 and 1954.

for paper and paperboard only; they exclude nonpaper product requirements for woodpulp:

	Million tons		
	For paper	*For paperboard*	*Total*
Groundwood	9.7	0.7	10.4
Sulfite	5.9	.7	6.6
Sulfate	11.3	11.4	22.7
Soda	.7	----	.7
Semichemical and other	2.2	4.8	7.0
Total	29.8	17.6	47.4

More Woodpulp Required for Nonpaper Products

Not all of the past increases in pulpwood consumption have been accounted for in paper and board manufacture. Beginning in 1910 with the manufacture of rayon fiber, dissolving grades of woodpulp have been used as basic raw material for an ever-growing list of products—cellophane, nitrocellulose, acetate plastics, photographic film, smokeless powder, tire cord, scotch tape, telephone parts, and plastic toys. Such material has appeared even in foods and pharmaceuticals.

Rayon manufacture has accounted for most of the woodpulp consumed in the manufacture of nonpaper products. Consumption climbed from about 45 thousand tons in 1930 to 547 thousand tons in 1955. In 1930 woodpulp supplied 62 percent of the refined cellulose consumed in the domestic manufacture of rayon, and cotton linters the remainder. In 1955 woodpulp supplied 86 percent of the total. There is every reason to believe that the output of rayon will continue to increase as it has in the past. The future rate of increase may be slower because rayon is in competition with a number of other synthetic fibers such as nylon. The possibility of further improvements in the utility of rayon fibers and of further displacement of cotton fiber by rayon may, however, tend to offset this.

Consumption of woodpulp in the manufacture of other nonpaper products has also been increasing rapidly. In 1939, such products required 70 thousand tons; in 1955, consumption amounted to 278 thousand tons.

Total consumption of woodpulp in the manufacture of nonpaper products in 1955 amounted to 826 thousand tons. Assuming further increases in the production of rayon and other non-

TABLE 253.—*Apparent consumption of woodpulp by grade in the United States, selected years, 1869–1955*

[Thousand tons]

Year	Total [1]	Sulfite [2]	Sulfate	Soda	Groundwood	Semichemical [3]
1869	1					
1879	23					
1889	306					
1899	1, 216					
1904	2, 091					
1907	2, 832					
1908	2, 358					
1909	2, 857					
1910	3, 032					
1911	3, 239					
1914	3, 556				1, 511	
1916	4, 079				1, 771	
1917	4, 149		194		1, 815	
1918	3, 870		265		1, 550	
1919	4, 114		271		1, 721	
1920	4, 696		389		1, 817	
1921	3, 544		316		1, 450	
1922	4, 756	2, 068	574	417	1, 700	
1923	5, 149	2, 193	591	448	1, 868	49
1924	5, 214	2, 248	645	439	1, 889	
1925	5, 588	2, 348	772	470	1, 943	55
1926	6, 092	2, 569	913	495	2, 068	46
1927	5, 957	2, 562	997	485	1, 856	57
1928	6, 232	2, 596	1, 218	486	1, 860	72
1929	6, 690	2, 805	1, 358	519	1, 911	97
1930	6, 412	2, 639	1, 372	474	1, 859	68
1931	5, 952	2, 331	1, 453	376	1, 660	133
1932	5, 194	2, 017	1, 403	291	1, 392	91
1933	6, 139	2, 419	1, 818	391	1, 408	102
1934	6, 099	2, 380	1, 782	361	1, 486	90
1935	6, 687	2, 536	2, 079	425	1, 546	102
1936	7, 779	2, 933	2, 533	487	1, 703	123
1937	8, 645	3, 259	2, 873	510	1, 819	183
1938	7, 503	2, 506	2, 961	402	1, 492	142
1939	8, 881	2, 969	3, 602	447	1, 673	190
1940	9, 703	3, 045	3, 879	533	1, 804	442
1941	11, 205	3, 481	4, 573	494	2, 084	573
1942	11, 642	3, 559	4, 720	477	2, 090	796
1943	10, 685	3, 159	4, 251	434	2, 003	838
1944	10, 962	3, 011	4, 582	419	1, 946	1, 004
1945	11, 786	3, 348	4, 858	441	2, 049	1, 089
1946	12, 373	3, 487	5, 060	496	2, 202	1, 128
1947	14, 138	3, 957	6, 046	512	2, 359	1, 264
1948	14, 955	3, 959	6, 621	534	2, 466	1, 374
1949	13, 848	3, 329	6, 581	519	2, 169	1, 250
1950	17, 138	3, 937	8, 380	556	2, 495	1, 769
1951	18, 683	4, 160	9, 348	479	2, 792	1, 904
1952	18, 202	3, 878	9, 213	453	2, 622	2, 036
1953	19, 533	3, 851	10, 285	463	2, 602	2, 331
1954	19, 935	3, 755	10, 543	468	2, 668	2, 505
1955	22, 413	4, 163	11, 952	481	2, 961	2, 856

[1] Data for individual years may not add to totals because of rounding.
[2] Includes dissolving and special alpha grades of pulp.
[3] Includes semichemical, defibrated-exploded, screening, and miscellaneous.

Source: 1869–1938 and 1940–1942, United States Pulp Producers Association, *Wood Pulp Statistics*, reporting statistics of the Bureau of the Census. 1939 and 1942–1955, U. S. Department of Commerce, Bureau of the Census.

paper products, the medium requirement for new woodpulp in 1975 is estimated at 2 million tons, or more than double the consumption in 1955. Of this total, 1.3 million tons might be sulfite and 0.7 million tons sulfate. By the year 2000 further increase is anticipated. The medium estimate for that year is 3 million tons and the upper estimate is 4 million tons. These requirements are in addition to the previous estimates of woodpulp required for paper and paperboard.

Combining these estimates with those for paper and paperboard gives total projected demand for new woodpulp as follows:

	Million tons		
	For paper and paperboard	For non-paper products	Total
Medium projections:			
1975	47	2	49
2000	72	3	75
Upper projection:			
2000	91	4	95

Pulpwood

The foregoing medium and upper projections of new woodpulp demand rest on the assumption that prices of all woodpulp products will follow a trend roughly parallel to the trend of prices in general and to the trend of prices of competing materials. Before proceeding further, it is necessary to consider the implications of this assumption in some detail—in order to lay the groundwork for projections of future demand for pulpwood.

Real Price of Woodpulp Products Remarkably Stable

Analysis of the price-consumption relationship for woodpulp products [145] involves the same types of problems that were discussed with respect to lumber—except that the price data now available are less satisfactory than the price data for lumber. Among those available, the most reliable indicator of long-term trends in the price of woodpulp products appears to be a composite price index that includes not only the price of market pulp but also the price of paper and paperboard.[146]

[145] Analyses of this kind might more logically be based on the price of pulpwood rather than on price of woodpulp products. There is, however, no officially compiled series on the long-term price of pulpwood. Pulpwood cut from company-owned forest land doesn't usually change hands, so there is no occasion to put a price on it. Most companies, of course, buy pulpwood from other sources, but information on prices paid for such wood is not available nationally.

[146] Separate price-consumption analyses for woodpulp, paper, and paperboard would be desirable. The price data available, however, are not adequate for such analysis. Prior to 1929, for example, the price index for paper was based on two grades only—newsprint and manila wrapping paper; the price index of paperboard was based on three grades of "boxboard." The officially compiled series on the price of woodpulp is based on sales of so-called market pulp. But the volume of woodpulp that moves in this trade is less than 20 percent of total woodpulp consumption. The other 80 percent is utilized by integrated mills and sold in the form of paper, paperboard, and other woodpulp products. The quantities of the various types of woodpulp that enter the market pulp trade are not representative of the type-distribution of all pulp consumed. Furthermore, the price of market pulp is quite erratic, because of fluctuations of imports and the variable quantities of pulp put on the open market by integrated mills. In view of all these factors, the price of market pulp alone is not a satisfactory indicator of price of woodpulp products in general.

The 1920–54 trend in the composite real price of woodpulp, paper, and paperboard shows no discernible upward or downward movement of any significance (table 254). Moderate fluctuations have occurred, but the tendency has been for price of woodpulp products repeatedly to come back into line with the general trend of all commodity prices. In view of the rapid expansion of demand for woodpulp products, this record of price stability is truly remarkable.

In contrast, the relative consumption of pulpwood has fluctuated considerably (table 255). Using the index number 100 to represent 1926 relative consumption, the long-term increase was from 65 in 1915–17 to 183 in 1950–52. The difference between the 1915–17 3-year average of relative consumption and the 1950–52 3-year average amounts to 182 percent—equal to an annual rate, for the whole 45-year period, of 2.33 percent per year.

There is little evidence to indicate that changes in real price of woodpulp products have exerted much influence on the relative consumption of pulpwood (fig. 127). It is true that in the late 1930's real price crept upward while relative consumption was decreasing, but the period of time is much too short to justify any broad inference with respect to the impact of price-change upon consumption. In the post-World War II period real price has tended to rise again. This may have had some effect in slowing the rate of relative-consumption increase, but the evidence certainly is not conclusive.

Pulpwood Use Depends on Type of Woodpulp Made

The quantity of woodpulp obtainable from a cord of wood depends upon the pulping process used and also upon the density and other physical characteristics of the wood. In recent years, the average number of cords of pulpwood consumed per ton of woodpulp produced has been increasing (table 256). This primarily reflects an increase in the production of bleached pulps, which use (as the result of more processing) more wood per ton of pulp produced (table 257).

In the future, some further rise in the production of bleached pulps is expected, particularly for sulfate pulp. This will tend to increase wood use; but improved efficiency in processing equipment, a shift to the high-yield pulping processes, and greater use of the high-density hardwoods will offset this increase and tend to lower average pulpwood use per ton of woodpulp produced from 1.63 cords in 1955 to about 1.5 in 1975.

With consideration of these factors, the 1975 medium estimates of new woodpulp requirements

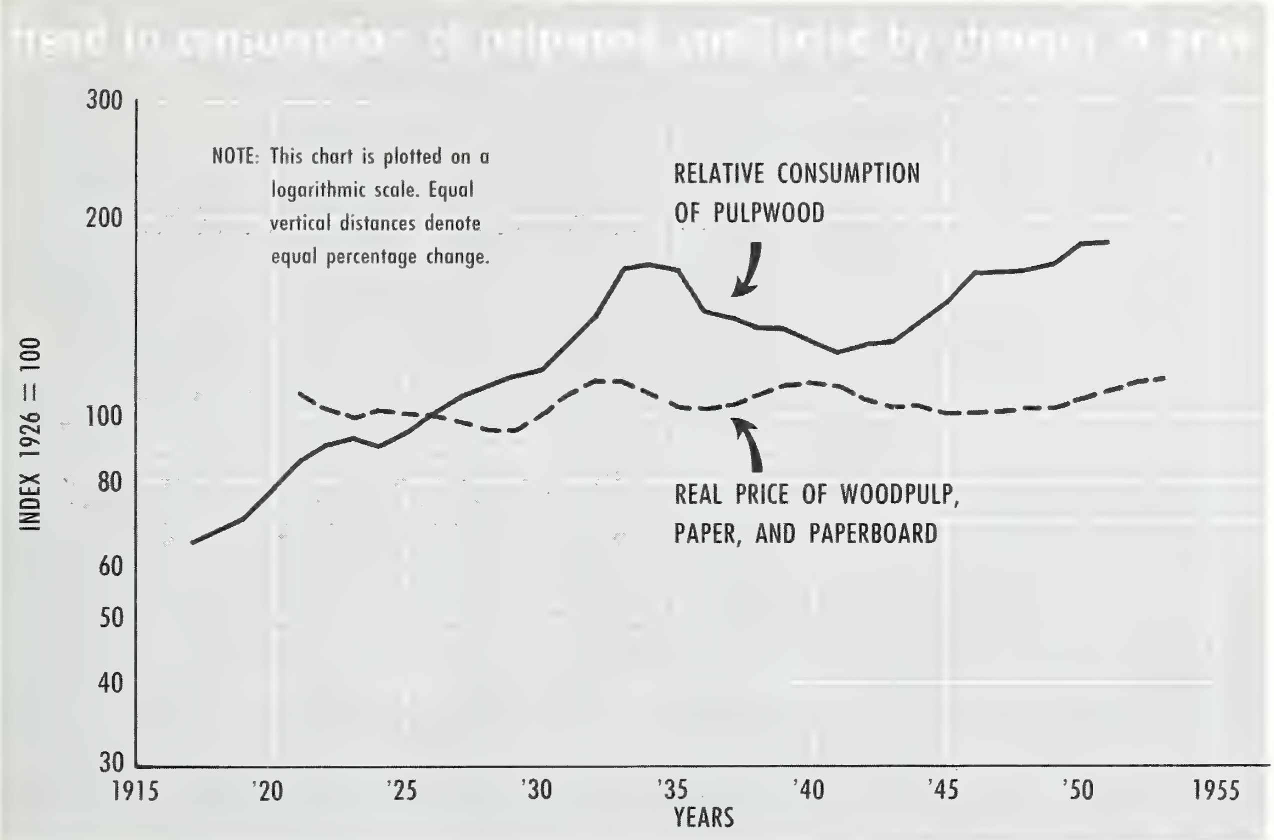


Figure 127

TABLE 254.—*Indexes of average price and real price of woodpulp products, 1920–54*

[1926=100]

Year	Woodpulp products, index of average annual price	All-commodity price index	Real price of woodpulp products: Index [1]	Real price of woodpulp products: Index smoothed by 3-year moving average	Year	Woodpulp products, index of average annual price	All-commodity price index	Real price of woodpulp products: Index [1]	Real price of woodpulp products: Index smoothed by 3-year moving average
1920	181. 8	154. 4	117. 7	----------	1938	85. 0	78. 6	108. 1	107. 1
1921	107. 6	97. 6	110. 2	107. 5	1939	82. 4	77. 1	106. 9	110. 6
1922	91. 6	96. 7	94. 7	102. 4	1940	91. 7	78. 6	116. 7	112. 0
1923	102. 8	100. 6	102. 2	99. 9	1941	98. 2	87. 3	112. 5	110. 4
1924	100. 7	98. 1	102. 7	102. 2	1942	100. 8	98. 8	102. 0	105. 2
1925	105. 2	103. 5	101. 6	101. 4	1943	104. 1	103. 1	101. 0	102. 0
1926	100. 0	100. 0	100. 0	100. 0	1944	107. 1	104. 0	103. 0	102. 3
1927	93. 8	95. 4	98. 3	97. 6	1945	108. 8	105. 8	102. 8	101. 5
1928	91. 4	96. 7	94. 5	95. 4	1946	119. 4	121. 1	98. 6	101. 1
1929	88. 9	95. 3	93. 3	95. 8	1947	155. 1	152. 1	102. 0	100. 9
1930	86. 1	86. 4	99. 7	101. 5	1948	168. 5	165. 1	102. 1	102. 6
1931	81. 4	73. 0	111. 5	109. 2	1949	160. 8	155. 0	103. 7	102. 3
1932	75. 5	64. 8	116. 5	114. 7	1950	163. 5	161. 5	101. 2	105. 0
1933	76. 6	65. 9	116. 2	114. 4	1951	198. 0	179. 8	110. 1	108. 1
1934	82. 7	74. 9	110. 4	108. 9	1952	[2] 197. 6	174. 8	113. 0	112. 4
1935	80. 0	80. 0	100. 0	103. 4	1953	197. 0	172. 5	114. 2	113. 8
1936	80. 7	80. 8	99. 9	102. 1	1954	197. 3	172. 8	114. 2	----------
1937	91. 7	86. 3	106. 3	104. 8					

[1] Obtained by dividing the index number for average annual price of woodpulp products by the corresponding index number for all commodity prices.

[2] The index from 1952 onward includes a wider range of products under the title "Pulp, Paper, and Products."

Source: U. S. Department of Labor, Bureau of Labor Statistics, *Wholesale Price Indexes.*

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TABLE 255.—*Index of relative consumption of pulpwood, 1916–52*

Year	Estimated consumption of pulpwood [1]	Per capita consumption of pulpwood		Per capita consumption of all physical-structure materials, index [2] (1926=100)	Relative consumption of pulpwood	
		Quantity	Index (1926=100)		Index (1926=100)	Index smoothed by 3-year moving average (1926=100)
	Thousand cords	*Cord*				
1916	6, 656	0. 065	63. 1	95. 9	65. 8	----------
1917	6, 835	. 066	64. 1	102. 4	62. 6	64. 8
1918	6, 566	. 064	62. 1	94. 2	65. 9	68. 1
1919	6, 752	. 065	63. 1	83. 3	75. 8	71. 2
1920	8, 240	. 077	74. 8	104. 1	71. 9	78. 6
1921	6, 621	. 061	59. 2	67. 1	88. 2	86. 0
1922	9, 022	. 082	79. 6	81. 2	98. 0	91. 0
1923	9, 957	. 088	85. 4	98. 3	86. 9	92. 9
1924	10, 194	. 089	86. 4	92. 1	93. 8	90. 8
1925	10, 778	. 093	90. 3	98. 6	91. 6	95. 1
1926	12, 106	. 103	100. 0	100. 0	100. 0	101. 3
1927	12, 206	. 103	100. 0	89. 0	112. 4	107. 5
1928	12, 928	. 107	103. 9	94. 5	110. 0	110. 7
1929	13, 989	. 110	106. 8	97. 3	109. 8	115. 2
1930	13, 188	. 107	103. 9	82. 5	125. 9	117. 9
1931	12, 075	. 097	94. 2	79. 8	118. 0	129. 4
1932	10, 487	. 084	81. 6	56. 5	144. 4	141. 4
1933	12, 240	. 097	94. 2	58. 2	161. 9	166. 6
1934	12, 549	. 099	96. 1	49. 7	193. 4	168. 0
1935	13, 810	. 108	104. 9	70. 5	148. 8	165. 7
1936	15, 966	. 124	120. 4	77. 7	155. 0	144. 5
1937	18, 286	. 142	137. 9	106. 2	129. 8	141. 4
1938	14, 902	. 115	111. 7	80. 1	139. 5	136. 8
1939	17, 387	. 133	129. 1	91. 4	141. 2	135. 7
1940	18, 026	. 136	132. 0	104. 5	126. 3	130. 5
1941	21, 450	. 161	156. 3	126. 0	124. 0	125. 6
1942	22, 259	. 165	160. 2	126. 7	126. 4	127. 0
1943	20, 455	. 150	145. 6	111. 6	130. 5	128. 2
1944	21, 150	. 153	148. 5	116. 4	127. 6	138. 0
1945	22, 976	. 164	159. 2	102. 1	155. 9	148. 7
1946	25, 127	. 178	172. 8	106. 2	162. 7	164. 6
1947	28, 318	. 197	191. 3	109. 2	175. 2	164. 8
1948	30, 297	. 207	201. 0	128. 4	156. 5	165. 1
1949	28, 464	. 191	185. 4	113. 4	163. 5	168. 2
1950	33, 659	. 222	215. 5	116. 8	184. 5	180. 7
1951	36, 158	. 234	227. 2	117. 1	194. 0	182. 6
1952	35, 419	. 226	219. 4	129. 5	169. 4	----------

[1] Includes pulpwood equivalent to net imports of woodpulp and of paper.

[2] Source: Bureau of the Census. *Raw Materials in the United States Economy, 1900–1952*, p. 60. Washington, D. C. 1954.

TABLE 256.—*Quantity of pulpwood consumed per ton of woodpulp output, specified years, 1935–55*

[Cords of wood per ton of pulp]

Year	Type of pulp					Average for all types
	Groundwood	Sulfite	Sulfate	Soda	Semichemical and other	
1935	0.93	1.97	1.65			1.55
1936	.93	1.91	1.64			1.53
1937	.92	2.02	1.67	1.76	0.76	1.58
1938	.91	1.92	1.65	1.82	.91	1.55
1939	.91	1.90	1.64	1.73	.95	1.55
1940	.97	1.90	1.59	1.84	.94	1.53
1947	.98	2.01	1.77	1.95	1.02	1.62
1955	1.02	1.99	1.80	1.90	1.07	1.63

Source: United States Pulp Producers Association. *Woodpulp Statistics*. 1956 ed. New York. (Reporting statistics of the Bureau of the Census.)

TABLE 257.—*Shifts toward increased production of bleached pulps, 1940–55*

[Thousand tons]

Year	Sulfite			Sulfate		
	Total production	Bleached		Total production	Bleached	
		Quantity	Percent		Quantity	Percent
1940	2,608	1,612	62	3,748	585	16
1945	2,360	1,544	65	4,472	854	19
1950	2,844	2,103	74	7,506	1,793	24
1955	3,251	2,605	80	11,577	3,625	31

Source: United States Pulp Producers Association. *Woodpulp Statistics*. 1956 ed. New York. (Reporting statistics of the Bureau of the Census.)

(for nonpaper products as well as for paper and paperboard) are converted to corresponding estimates of pulpwood:

Grade:	*Woodpulp (million tons)*	*Pulpwood (million cords)*
Sulfite	7.9	15.0
Sulfate	23.4	39.0
Soda	.7	1.5
Groundwood	10.4	10.0
Semichemical and other	7.0	6.5
Total	49.4	72.0

By 2000, assuming a further shift toward the use of dense hardwoods, increased use of the high-yield pulping processes, and further improvement in plant operating efficiency, use of pulpwood per ton of woodpulp requirements may decline still more from 1.5 cords in 1975 to 1.3 in 2000.

Summary of Projected Demand for Pulpwood

Estimates of 1952 consumption of pulpwood, and projections of pulpwood demand to 1975 and 2000, are as follows:

	Million cords
Consumption in 1952	35.4
Projections to 1975:	
Lower	65.0
Medium	72.0
Projections to 2000:	
Lower	90.0
Medium	100.0
Upper	125.0

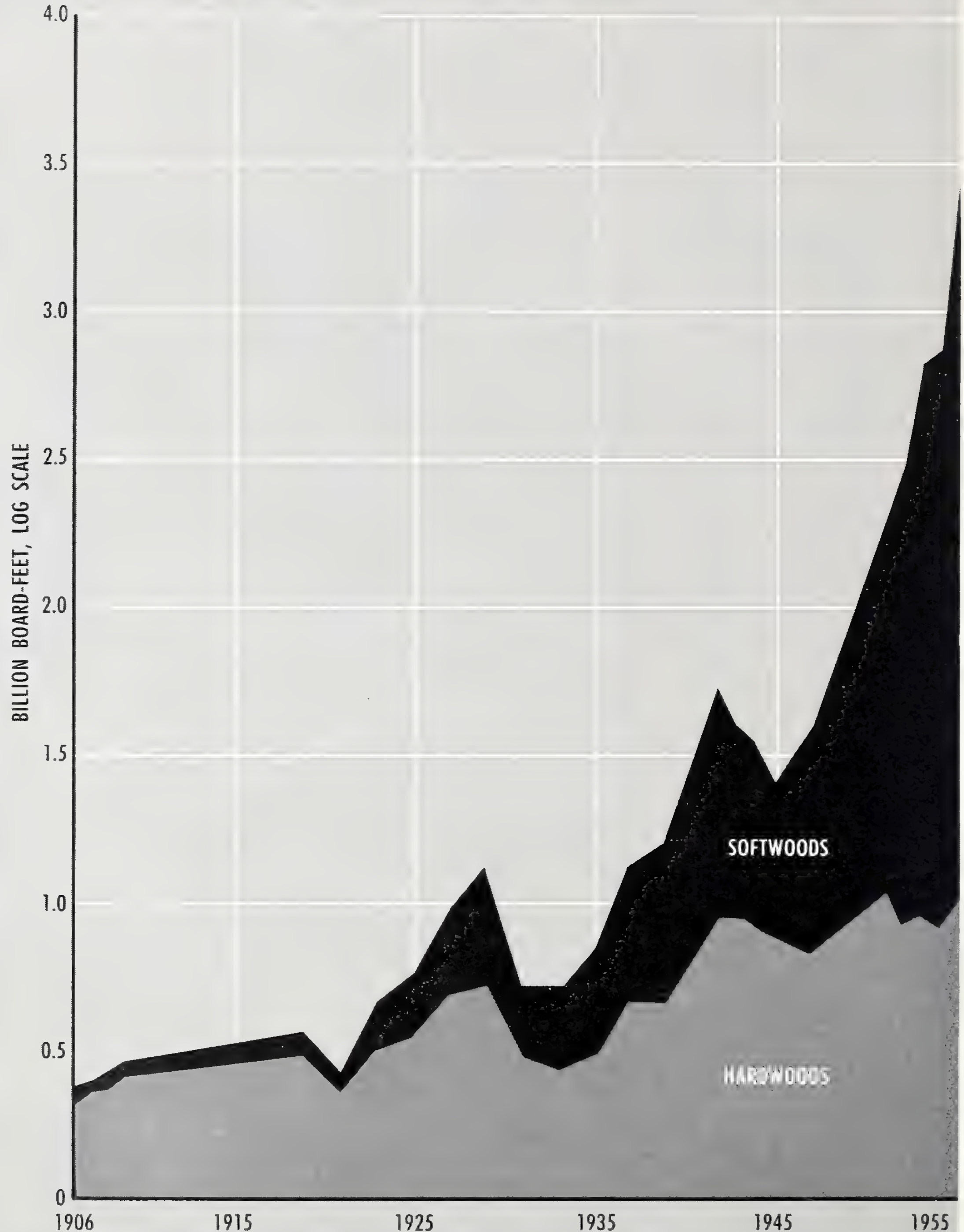
The medium projection rests on the assumptions that the United States population will grow to 215 million by 1975 and 275 million by 2000. The upper projection anticipates a 2000 population of 360 million. Both of these projections also assume no change in the real price of woodpulp products, woodpulp, or pulpwood.

Lacking clear historical indications of what effect a substantial increase in prices would have upon demand for pulpwood, the lower projections are largely a matter of judgment. Wood, because of lower costs of handling, storing, and processing, is the cheapest source of raw material for pulp and is the only present economic source of raw material existing in sufficient volumes. There is no immediate prospect that any other fiber will replace pulpwood. If, however, the price of pulpwood increases substantially faster than the price of substitute materials, it is estimated that waste paper and materials such as straw and bagasse may displace pulpwood to the extent of about 10 percent of the medium projection in both 1975 and 2000.

The softwood-hardwood distribution of future pulpwood demand is likely to be determined more by supply factors than demand factors. With the sulfate and semichemical processes, most hardwood species can be used. Since hardwoods are likely to be more plentiful than softwoods in 1975 and 2000, a marked increase in the proportions of hardwoods used is expected—from about 12 percent in 1952 to 26 percent in 1975 and 2000.

FUTURE DEMAND FOR VENEER LOGS AND BOLTS

Logs and bolts utilized for manufacture of veneer and plywood comprised about 4 percent of United States consumption of industrial wood in 1952. The volume increased from 329 million board-feet in 1906 to 3,431 million in 1955—a tenfold growth in 50 years (table 258). The 1955 figure includes about 2.4 billion board-feet of softwoods and about 1 billion board-feet of hardwoods. Since 1945 the softwood sector of the industry has been expanding at a phenomenal rate (fig. 128).



SOURCE: U.S. Department of Commerce, Bureau of the Census.
U.S. Department of Agriculture, Forest Service.

Figure 128

Production of softwood veneer and plywood and of hardwood veneer and plywood are generally considered as two industries. Their products compete to some extent, but each has a market domain in which its products are clearly dominant.

TABLE 258.—*Estimated volume of logs and bolts consumed in manufacture of veneer and plywood in specified years, 1906–55*

[Million board-feet, log scale]

Year	All species	Softwood	Hardwood
1906	329	52	277
1907	349	39	310
1908	383	51	332
1909	436	56	380
1919	577	93	484
1921	400	70	330
1923	646	151	495
1925	735	194	541
1927	962	290	672
1929	1, 113	394	719
1931	696	228	468
1933	700	282	418
1935	824	340	484
1937	1, 114	460	654
1939	1, 194	544	650
1942	1, 736	797	939
1943	1, 594	659	935
1944	1, 533	647	886
1945	1, 404	546	858
1947	1, 570	751	819
1951	2, 271	1, 232	1, 039
1952	2, 467	1, 548	919
1953	2, 815	1, 861	954
1954	[1] 2, 878	[1] 1, 978	[1] 900
1955	[1] 3, 431	2, 431	[1] 1, 000

[1] Estimate.

Source: 1906–33, U. S. Department of Commerce data republished in Sowder, A. M., and Marquis, R. W., *Timber Requirements for Veneer and Plywood*, Forest Service, Washington, D. C., 1941, p. 8. 1935–47, Forest Service, *Materials Survey*, Washington, D. C., 1950, table 48. 1951–53 and 1955, U. S. Department of Commerce, *Facts for Industry, Softwood Plywood and Veneer, Summary for 1952*, p. 6; *Summary for 1953*, p. 2; *Summary for 1955*, p. 2; *Facts for Industry, Hardwood Veneer 1952*, p. 3, *Hardwood Veneer 1953*, p. 3. Department of Commerce 1952 data adjusted to include log consumption of "green veneer" mills.

SOFTWOOD PLYWOOD AND VENEER

The softwood veneer and plywood industry includes about 120 mills located in the Pacific Northwest and California. Production is based chiefly on Douglas-fir, which comprises from 95 to 98 percent of all wood consumed. Other species—used to a limited extent—include ponderosa pine and western hemlock. In 1955, 4 percent of the softwood veneer[147] produced was used for containers and 96 percent was used for plywood:

	Volume of logs and bolts (log scale)	
	Million board-feet	*Percent*
Utilized for plywood:		
Douglas-fir	2, 236	92
Ponderosa pine	40	2
Other species	61	2
Total	2, 337	96
Utilized for container veneer:		
Douglas-fir	66	3
Ponderosa pine	1	---
Other species	27	1
Total	94	4
Total volume processed:		
Douglas-fir	2, 302	95
Ponderosa pine	41	2
Other species	88	3
All species	2, 431	100

Source: U. S. Department of Commerce. *Facts for Industry, Softwood Plywood and Veneer, 1955*, p. 2. Washington, D. C. 1957.

The rapid expansion in uses of softwood plywood in recent years can be attributed largely to the development of moisture-resistant and waterproof glues. Prior to World War I most of the glues used in plywood production were not resistant to moisture. In the 1920's moisture-resistant glues were developed, and during the mid-1930's several waterproof glues were introduced. "Exterior grade" plywood, bonded with these waterproof glues, can be used in exposed locations without risk of glue failure. In 1955, about 1,250 million square feet (⅜ inch basis)—24 percent of the softwood plywood manufactured—was exterior-grade material.

The trend in production (table 259) and consumption of plywood[148] has followed the trend of log consumption. Between 1939 and 1955, the period in which uses of softwood plywood have been well established, consumption has increased 399 percent, or at an average annual rate of 10.6 percent.

This rapid increase of softwood plywood consumption reflects extensive substitution of plywood for lumber. Softwood plywood sheathing and subflooring, for example, provide an excellent base for laying most types of roofing, siding, and flooring. This, along with the fact that plywood can be installed at the construction site with less labor, has induced much of the substitution.

[147] Veneer, normally ⅛ or 1/10 inch thick, is the product cut from the log.

[148] Only limited data are available on actual consumption of softwood plywood, but production closely approximates consumption. There is a small volume of international trade in softwood plywood, and stocks fluctuate from year to year, but not to any large extent in comparison with annual production.

TABLE 259.—*Production of softwood plywood, specified years, 1929–55*

[Million square feet, ⅜ inch basis]

Year	Quantity produced	Year	Quantity produced
1929	358	1943	1, 495
1930	305	1944	1, 485
1931	235	1945	1, 222
1932	200	1946	1, 436
1933	390	1947	1, 700
1934	384	1948	1, 954
1935	480	1949	1, 977
1936	700	1950	2, 676
1937	725	1951	2, 995
1938	650	1952	3, 178
1939	1, 032	1953	3, 848
1940	1, 200	1954	3, 989
1941	1, 805	1955	5, 147
1942	1, 840		

Source: 1929–38 and 1940, *The Timberman*, January 1952, p. 57, based partly on data published by Bureau of the Census. 1939 and 1941–42, *Business Statistics, 1953*, p. 155. 1943–46, *Statistical Abstract of the United States, 1954*, p. 728. 1947–55, *Facts for Industry, Softwood Plywood and Veneer, 1955*, p. 2. The last three named are U. S. Department of Commerce publications.

About One-Fourth of Softwood Plywood Used in Manufacture and in Shipping

In 1948, 411 million square feet (⅜ inch basis) of softwood plywood was used in the fabrication of fixtures, furniture, truck and truck-trailer bodies, and various other items.[149] Another 312 million square feet was used in the manufacture of containers.[150]

With allowance for more extensive use of plywood in the fabrication of manufactured products and the increased output of such products, and assuming some increased use in shipping, the quantity of softwood plywood consumed in these uses in 1955 is estimated at about 1.3 billion square feet.[151] This volume represents 24 percent of the 5.4 billion square feet (⅜ inch basis, container veneer included) of softwood plywood produced in 1955.

Softwood plywood and veneer are expected to maintain their present position in manufacturing and shipping and to make some gains at the expense of lumber. Allowing for a moderate expansion in these uses, for the anticipated increases in the output of manufactured products containing wood, for some increased use in shipping, and for stable relative prices, demand in 1975 may amount to 2.2 billion square feet (⅜ inch basis). By 2000, demand may increase to 3.4 billion square feet or to 3.9 billion—depending on whether population increases to 275 million or to 360 million. These estimates represent increases of 69 percent in the period 1955–75 and 162 percent or 200 percent during the period 1955–2000.

[149] U. S. Forest Service, *Wood Used in Manufacture 1948*, p. 28. Washington, D. C., 1951. (Plywood volume converted from square feet, 1 inch thick equivalent.)

[150] No separate estimates of demand for softwood container veneer are made, since it accounts for only 4 percent of the softwood logs and bolts used in veneer production.

[151] Includes the plywood equivalent (⅜ inch basis) of container veneer.

Softwood Plywood Mainly Used for Construction

Most softwood plywood used in construction goes into housing. Plywood, since the early days of its production, has been a popular material for door panels and cabinets. It gradually came into general use for interior wall panels, ceiling panels, partitions, subflooring, and as sheathing in walls and roofs. It is used extensively for prefabricated and ready-cut dwellings and other buildings such as garages, and in the construction of farm and multifamily dwelling units.

In the first three months of 1956, softwood plywood was used for one purpose or another in 78 percent of all new nonfarm single-family houses started:

	Houses (number)	*Percent of all houses started*
Total houses started	218, 600	100
Houses in which plywood was used in one or more components	171, 500	78
Roof sheathing	42, 000	19
Exterior-wall sheathing	26, 000	12
Exterior-wall facing	12, 500	6
Subflooring	121, 600	56
Interior walls and ceilings	17, 400	8
Builtins, partitions, and misc	70, 600	32
Use not reported	1, 900	1

Source: U. S. Department of Labor, Bureau of Labor Statistics. *Characteristics of New Housing, First Quarter, 1956. Pt. II, Special Characteristics, Equipment and Appliances*, p. 16. Washington, D. C. 1956.

On the average, 1,357 square feet (⅜ inch basis) per dwelling unit was used in this type of housing. Application of this factor to the estimated number of nonfarm and farm single-family houses built in 1955 (1,340 thousand) indicates a total consumption of about 1.8 billion square feet of softwood plywood in all single-family dwellings built in that year. Single-family dwellings accounted for about 91 percent of all new residential construction in 1955. The total quantity of softwood plywood used in all types of housing is estimated at 2.0 billion square feet (⅜ inch basis). Allowing for plywood used in the construction of garages and other house accessories raises this estimate to 2.2 billion square feet for all new residential construction uses.

If the average volume of softwood plywood used per dwelling increases from about 1,200 square

feet (3/8 inch basis) in 1952 to 2,000 square feet by 1975 and to 2,400 by the year 2000, and if the rate of new residential construction increases as explained previously, demand for softwood plywood for these uses by 1975 may amount to 4.0 billion square feet (3/8 inch basis). By 2000, it may rise to 6.0 billion square feet or 7.2 billion—depending on whether 2.5 million or 3.0 million dwelling units are then constructed.

Another important use is in maintenance and repair construction, including alterations and additions. This last type of construction often involves new partitions, lining of unfinished space (such as basements and attics) or other structural changes. Plywood is ideally suited for these purposes because it can be put in place at minimum cost, with simple tools and by unskilled labor. Expenditures for maintenance and repair construction are expected to increase 53 percent in the period 1955–75 and 177 percent or 224 percent in the period 1955–2000.

In nonresidential construction, plywood is used chiefly for concrete forms. It is particularly suitable where smooth or curved concrete surfaces are desired. The moisture-proof and moisture-resistant types can often be reused several times. By 1975, expenditures for nonresidential construction are expected to be 35 percent above 1955 and, by 2000, 193 or 249 percent higher.

In developing estimates of the quantity of softwood plywood that may be demanded for these purposes, it has been assumed that the average use of plywood per dollar of expenditures will increase at a somewhat faster rate than overall expenditures because of the continued displacement of lumber by plywood—even though relative prices of each follow the same trend. In the case of nonresidential construction, plywood use per dollar of expenditures is assumed to increase 83 percent by 1975 and 217 or 242 percent by 2000. The corresponding relationships assumed for maintenance and repair construction are 71 percent by 1975 and 157 or 229 percent by 2000.

Applying these percentages to 1955 consumption of softwood plywood for new nonresidential construction and for all maintenance and repair, and adding the resulting estimates to new residential construction as previously developed, the total use of softwood plywood (in billion square feet, 3/8 inch basis) for all construction may be as follows:

Year:	*New residential*	*All other construction* [1]	*Maintenance and repair*	*All construction*
1955	2. 2	1. 2	0. 7	4. 1
1975	4. 0	2. 2	1. 2	7. 4
2000	6. 0	3. 8	1. 8	11. 6
	7. 2	4. 1	2. 3	13. 6

[1] Includes maintenance and repairs on farms, railroads, and mines.

When these construction uses are added to the estimates of use in manufacturing and shipping, the total estimates of demand for softwood plywood provide for increases of 78 percent during the period 1955–75 and of 178 percent or 224 percent during the period 1955–2000, as follows:

	Billion sq. ft., 3/8 inch basis		
Year:	*Construction*	*Manufacturing and shipping*	*Total*
1955	4. 1	1. 3	5. 4
1975	7. 4	2. 2	9. 6
2000	11. 6	3. 4	15. 0
	13. 6	3. 9	17. 5

These estimates are large in comparison with the demand increases estimated for lumber, but still very moderate in comparison with the rate at which softwood plywood consumption has been increasing—roughly 1,000 percent during the 20-year period 1935–55.

Hardwood Veneer and Plywood

The hardwood plywood and veneer industry includes about 500 mills located chiefly in the southern States and in Wisconsin, Michigan, Indiana, Ohio, New York, and Vermont. In contrast to the softwood industry, it uses a wide variety of species:[152]

Species group:	*Million bd.-ft., log scale*	*Percent*
Birch, beech, cherry, maple, oak, walnut	188	20
Gum, yellow-poplar, basswood, cottonwood	627	66
Other domestic hardwoods	111	11
Imported tropical hardwoods	28	3
Total consumption	954	100

Hardwood plywood and veneer have highly diversified uses in construction and in manufacturing. In construction, hardwood plywood and veneer are mainly used for interior paneling, cabinetwork, and doors. In manufacturing, they are widely used in furniture and fixtures, radio and television cabinets, small boats, and similar items. In general, the hardwood product is preferred where appearance, hardness, and sonic properties are important.

Total hardwood veneer production in 1953 amounted to about 10.1 billion square feet, surface measure basis. About 60 percent of this was used in the manufacture of hardwood plywood:

Type:	*Billion square feet, surface measure*	*Percent*
Special and face	1. 9	19
Commercial and utility	4. 7	47
Container	3. 1	30
Flat	. 4	4
Total all types	10. 1	100

[152] U. S. Department of Commerce, Bureau of the Census, *Facts for Industry, Hardwood Veneer, 1953.* Washington, D. C., 1954. (Hardwood veneer and plywood are reported in square feet only, with no designation of thickness.)

Special-type veneers must meet exacting specifications. This material is used for decorative effect in quality furniture and as facing in wall paneling and flush doors. The commercial and utility type is used in plywood for containers and for cores and backing in the higher grades of plywood. Container veneer is used for wire-bound boxes and crates, for baskets and hampers, and for other containers in which no gluing is required. Flat-type veneer is used for items such as ice cream spoons and sticks, tongue depressors, and as parts of woodenware and novelties.

Very little information is available to indicate trends in consumption, but the volume of logs and bolts processed increased rather steadily from 1906 to 1951, the trend being interrupted only in the depression years. From 1951 to 1955 the volume has remained at about 1 billion board-feet. Prior to 1950, with the exception of the war years, consumption of logs and bolts has been a good indicator of the trend in the consumption of hardwood veneer and plywood. Since 1950, however, net imports of hardwood veneer and plywood have increased very rapidly and have accounted for a significant part of total consumption:

	Million sq. ft., surface measure	
	1952	*1955*
Veneer production	10, 283	[1] 10, 600
Net imports of veneer	[2] 613	[2] 2, 566
Apparent consumption	10, 896	13, 166

[1] Estimated.
[2] Includes veneer equivalent of net imports of plywood.

Because the uses of hardwood veneer and plywood are so highly diversified, a detailed use-by-use analysis of future demand is not practicable here. In the past few decades, hardwood plywood and veneer consumption has increased at a slower rate than softwood plywood. Assuming that this relationship to softwood continues, it appears reasonable to expect that the demand for the hardwood product in 1975 may be in the neighborhood of 21.0 billion square feet or 60 percent above 1955 consumption. Demand in the year 2000 is estimated at 34 billion square feet or 39 billion square feet. Such increases would be generally in line with the experience of the past 20 to 40 years.

Trends in Real Price and Relative Consumption of Plywood

Since the advent of plywood and other veneer products as one of our major industrial raw materials is of comparatively recent origin, long-term price information is available only for interior-grade Douglas-fir plywood (table 260). In terms of the index of average price (1947–49=100), the price of such plywood rose from 33.6 in 1936 to 106.1 in 1955. But real price rose only from 64.0 in 1936 to 95.8 in 1955, an increase of approximately 50 percent. The significant comparison, however, is obviously not plywood price in relation to commodity prices in general or to prices of nonwood materials—but rather to the price of lumber, for which it is a major substitute. The price of plywood in relation to the price of lumber (1947–49=100) has come down from 116.3 in 1936 to 85.3 in 1955. This decrease of approximately 27 percent has undoubtedly been one of the major reasons for the widespread substitution of plywood for lumber.[153]

Per capita consumption of logs and bolts utilized in manufacture of veneer products has climbed from 3.85 board-feet in 1906 to 20.76 board-feet in 1955—a fivefold increase (table 261). Adjusting this upward trend for the general upward trend in per capita consumption of all the physical-structure materials shows that relative consump-

Table 260.—*Average annual price of softwood plywood in relation to all commodity prices, and to price of lumber, 1936–55*

[1947–49=100]

Year	Average annual price of plywood [1]	All-commodity price index	Real price of plywood [2]	Average annual price of lumber	Price of plywood relative to price of lumber [3]
1936	33. 6	52. 5	64. 0	28. 9	116. 3
1937	33. 5	56. 1	59. 7	33. 1	101. 2
1938	32. 9	51. 1	64. 4	29. 0	113. 4
1939	33. 7	50. 1	67. 3	31. 0	108. 7
1940	35. 1	51. 1	68. 7	34. 2	102. 6
1941	39. 1	56. 8	68. 8	40. 7	96. 1
1942	38. 8	64. 2	60. 4	44. 2	87. 8
1943	42. 8	67. 0	63. 9	47. 0	91. 1
1944	43. 7	67. 6	64. 6	50. 9	85. 9
1945	43. 7	68. 8	63. 5	51. 5	84. 9
1946	54. 2	78. 7	68. 9	59. 3	91. 4
1947	89. 3	96. 4	92. 6	94. 5	94. 5
1948	113. 5	104. 4	108. 7	107. 3	105. 8
1949	97. 2	99. 2	98. 0	98. 2	99. 0
1950	112. 0	103. 1	108. 6	114. 5	97. 8
1951	117. 3	114. 8	102. 2	123. 6	94. 9
1952	107. 2	111. 6	96. 1	120. 5	89. 0
1953	107. 1	110. 1	97. 3	119. 3	89. 8
1954	103. 0	110. 3	93. 4	117. 3	87. 8
1955	106. 1	110. 7	95. 8	124. 4	85. 3

[1] Douglas-fir plywood, interior grade.
[2] Obtained by dividing the index for average annual price of plywood by the corresponding all-commodity price index.
[3] Obtained by dividing the index for average annual price of plywood by the corresponding index for average price of lumber.

Source: U. S. Department of Labor, Bureau of Labor Statistics. *Index of Wholesale Prices.*

[153] Other reasons include the savings in labor of installation and the standardization of the product as to quality and dimensions.

tion of logs and bolts for veneer and veneer products (1947=100.0) increased from 36.5 in 1906 to 121.8 in 1952.

The comparison of trends in relative consumption of veneer products against real price of Douglas-fir plywood and price of that plywood in relation to price of lumber provides such fragmentary data that statistical analyses of the possible future impact of price upon quantity of veneer products demanded are precluded (fig. 129).

Projections of Demand for Veneer Logs and Bolts

Considerable progress has been made in recovering more usable veneer from logs and bolts processed. It is to be expected that further progress in this direction will be forthcoming, at least during the next 20 years. Allowance has been made for such improvement in future utilization in proceeding from the previously developed estimates of veneer and plywood demand to estimates of demand for veneer logs and bolts.

The volumes of logs and bolts required to meet demand for softwood plywood and veneer, if there is no change in real or relative prices, are as follows:

	Plywood and veneer (billion sq. ft., ⅜ inch basis)	*Veneer logs and bolts (billion bd.-ft., log scale)*
1952	[1] 3. 3	1. 6
1955	[1] 5. 4	2. 4
1975	9. 6	3. 9
2000	15. 0	6. 0
	17. 5	7. 0

[1] Reported production of plywood plus a 4-percent allowance for container-veneer production.

These estimates imply a 62 percent increase in demand for softwood logs and bolts during the period 1955–75 (144 percent in the period 1952–75), and a 150 percent or a 192 percent increase during the period 1955–2000.

Hardwood veneer log and bolt requirements, derived from the foregoing veneer and plywood estimates on the assumption of no change in real or relative price, also allow for some decrease in 2000 yields from the levels attained in 1975:

	Veneer (billion sq. ft., surface measure)	*Veneer logs and bolts (billion bd.-ft., log scale)*
1952	11. 0	1. 0
1955	[1] 13. 2	[1] 1. 2
1975	21. 0	1. 7
2000	34. 0	3. 0
	39. 0	3. 5

[1] Estimated.

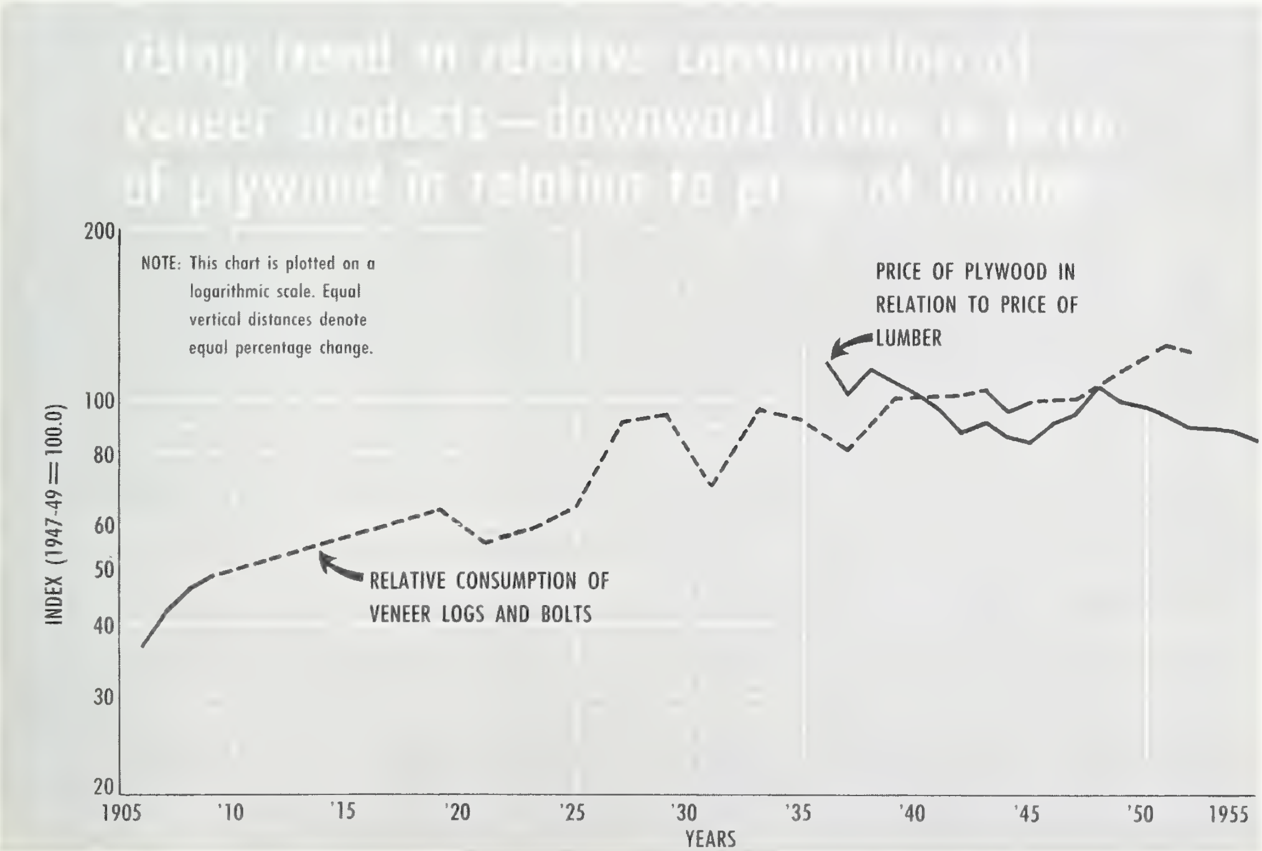


Figure 129

TABLE 261.—*Consumption of veneer logs and bolts in relation to consumption of all physical-structure materials, specified years, 1906–55*

Year	Estimated consumption of veneer logs and bolts [1]	Per capita consumption of veneer logs and bolts	Index of per capita consumption of veneer logs and bolts (1947=100.0)	Index of per capita consumption of all physical-structure materials [2] (1947=100.0)	Relative consumption of veneer logs and bolts [3] (1947=100.0)
	Million board-feet	*Board-feet*			
1906	329	3.85	35.4	96.9	36.5
1907	349	4.01	36.8	87.5	42.1
1908	383	4.32	39.7	85.9	46.2
1909	436	4.82	44.3	90.9	48.7
1919	577	5.52	50.7	79.9	63.5
1921	400	3.69	33.9	61.4	55.2
1923	646	5.77	53.0	90.0	58.9
1925	735	6.35	58.3	90.3	64.6
1927	962	8.08	74.2	81.5	91.0
1929	1,113	9.14	83.9	89.0	94.3
1931	696	5.61	51.5	73.0	70.5
1933	700	5.57	51.1	53.3	95.9
1935	824	6.47	59.4	64.6	92.0
1937	1,114	8.64	79.3	97.2	81.6
1939	1,194	9.11	83.7	83.7	100.0
1942	1,736	12.87	118.2	116.0	101.9
1943	1,594	11.66	107.1	102.2	104.8
1944	1,533	11.08	101.7	106.7	95.3
1945	1,404	10.03	92.1	93.4	98.6
1947	1,570	10.89	100.0	100.0	100.0
1951	2,271	14.71	135.1	107.2	126.0
1952	2,467	15.71	144.3	118.5	121.8
1953	2,815	17.63	161.9	----	----
1954	2,878	17.72	162.7	----	----
1955	3,431	20.76	190.6	----	----

[1] Forest Service estimates based on Bureau of the Census data.
[2] U. S. Department of Commerce, Bureau of the Census. *Raw Materials in the United States Economy, 1900–1952*, p. 60. Washington, D. C. 1954.
[3] Obtained by dividing the index of per capita consumption of veneer logs and bolts by the corresponding index of per capita consumption of all physical-structure materials.

The medium and upper projections of demand for veneer logs and bolts—based on the assumption that prices of veneer and veneer products will follow a trend roughly parallel to price of competing materials—are obtained by adding together the above estimates of softwood and hardwood log and bolt requirements. The lower projections, on the other hand, are based on the assumption that the price of timber products will rise faster than the price of competing materials.

An increase in price may stimulate substitution of nonwood materials for veneer products to a certain extent. But more important, it will probably stimulate substitution of other timber products such as hardboard and particle board, which can be made from mill residues and from wood not suitable for most other industrial uses. The relation of the price of plywood to price of lumber, on the one hand, and to the price of wood-fiber boards, on the other hand, will probably have more to do with future demand for veneer products than the price of competing nonwood materials.

Projections of future demand for veneer logs and bolts in 1975 and 2000 are summarized as follows:

	Billion board-feet
Consumption in 1952	2,647
Projections to 1975:	
Lower	5,000
Medium	5,670
Projections to 2000:	
Lower	7,500
Medium	9,000
Upper	10,500

The medium and lower projections for 1975 represent increases from 1952 of 89 and 114 percent respectively. For 2000, the increases over 1952 are 183, 240, and 297 percent respectively for the lower, medium, and upper projections. While these percentage increases appear to be rather generous, a substantial increase had already occurred by 1955.

Demand for softwood veneer logs and bolts is expected to rise more rapidly than demand for hardwood products. The softwood proportion represented 62 percent of consumption in 1952. By 1975 and 2000, the softwood products are expected to account for 70 percent of total demand for veneer logs and bolts.

FUTURE DEMAND FOR MINOR INDUSTRIAL-WOOD PRODUCTS

Minor industrial-wood products (minor in the sense that no one of them represents a large volume of wood in comparison with lumber, pulpwood, or veneer logs) include cooperage logs and bolts, piling, poles, fence posts, hewn ties, round mine timbers, and a miscellaneous assortment of other products.[154] The volume of logs and bolts used in production of these minor products in 1952 amounted to 699 million cubic feet, or slightly less than 7 percent of all industrial wood consumed.

Medium and lower projections of demand in 1975 are made for each product, but for 2000 all of the projections are made only for the group as a whole. As before, the medium and upper projections assume that the future price of timber products will rise no faster than the price of substitute materials. The lower projection assumes a substantial rise in relative price, which presumably would result in lowering the demand

[154] Such as bolts for turnery products, wood for making charcoal, shingle bolts, and furnace poles.

for minor wood products from the medium projections because of the substitution of other materials for wood.

Cooperage Logs and Bolts

The term "cooperage" applies to barrels, kegs, pails, and tubs, made of wood staves and heading, bound together with hoops. Tight cooperage is used for liquids, and slack cooperage for dry materials.

Fifty years ago, tight cooperage was used for storage and shipment of products such as whiskey, beer and ale, wine, molasses, vinegar, pickled products, lard and oils, petroleum products, and chemicals. Out of this list the only product still stored almost wholly in tight cooperage is whiskey. For the others, there has been a drastic displacement of tight cooperage by metal drums and cans, and by glass containers.

Slack cooperage has been used for storage and shipment of flour, sugar, salt, lime, cement, nails, rosin, and many other items. For many of these, slack cooperage has been displaced by wooden and fiber boxes, cotton bags, multiwall paper bags, fiber drums, and various other containers. Part of the trend away from the use of slack cooperage containers has been due to the practice of putting commodities in consumer-size packages before they leave the factory. The old cracker barrel, for example, has been replaced by sealed packages containing quantities that the average consumer is willing to buy at one time.

In 1906, about 1.5 billion board-feet of timber were used in the production of cooperage. In 1952, only 355 million board-feet were used (table 262).

Looking ahead to 1975, it appears likely that the trend in the consumption of timber for cooperage will be reversed. The displacement of wooden cooperage by other materials has probably run its course. It is expected that because of strength and ease of handling, there will be a continuing demand for slack cooperage in the packaging of certain materials, particularly for export, and also for tight cooperage for storage and shipment of whiskey and other spirituous liquors. On the basis of these suppositions, medium projected demand for cooperage logs and bolts in 1975 is estimated at 600 million board-feet and lower projected demand at 510 million board-feet.

The tight cooperage industry is very exacting in its wood requirements, since the woods used must be impermeable to liquids. For certain commodities, it is necessary to use woods that do not impart odor, flavor, or color to the contents. White oak has long been favored, especially for whiskey barrels. Slack cooperage need not be made of such high-quality wood as tight cooperage, although freedom from odor, flavor, and color is sometimes important. Oaks, gums, poplar, southern pines, spruce, and Douglas-fir are among the most widely used woods. The proportion of hardwood used for both tight and slack cooperage—one-third of the total—is expected to remain unchanged.

Table 262.—*Consumption of timber for cooperage, selected years, 1906–52* [1]

[Million board-feet, log scale]

Year	All cooperage	Tight cooperage	Slack cooperage
1906	1, 478	562	916
1908	1, 775	682	1, 093
1910	1, 706	742	964
1919	1, 486	725	761
1921	1, 149	547	602
1923	1, 136	489	647
1925	1, 182	544	638
1927	1, 307	698	609
1929	1, 461	779	682
1931	843	468	375
1933	639	336	303
1935	758	455	303
1937	833	415	418
1939	786	388	398
1947	558	275	283
1949	369	148	221
1950	455	197	258
1951	427	164	263
1952	355	92	263

[1] Data for years 1906–25 from U. S. Forest Serv. Stat. Bul. 21, *American Forests and Forest Products;* 1927–47, from Bur. Census, Census of Manufactures; 1949–51 from U. S. Dept. Com., N. P. A., *Containers and Packaging* industry reports. N. P. A. reports on number of barrels converted to timber volume by factor of 41 board-feet per barrel for tight cooperage and 12 board-feet per barrel for slack cooperage.

Piling

Wood piling is used chiefly in construction of docks, building foundations, and railroad trestles.

Information on the quantity of piling treated in wood preservation plants has been collected for many years, but little is known about the quantity of untreated piling installed from year to year. Partial surveys made in a few areas indicate that about 40 percent of all piling installed may be untreated material. This estimate, however, is not very reliable. During World War II, a large volume of untreated piling was installed. The average annual volume of piling treated and total consumption are estimated as follows:

	Volume treated (million cu. ft.)	*Volume consumed (million cu. ft.)*
1925–29	12. 9	21. 5
1930–34	10. 1	16. 8
1935–39	11. 3	18. 8
1940–44	21. 0	46. 6
1945–49	12. 7	21. 2
1950–51	14. 8	24. 7
1952	16. 7	28. 0

Wood piling will continue to be used for the same purposes it now serves. There will probably be some displacement by steel and concrete, and some decline in replacement demand because of the increased use of treated piling. In general, however, demand for piling can be expected to increase as nonresidential construction increases. Under this assumption, medium projected demand for piling in 1975 is set at 37 million cubic feet or 59 million linear feet. The corresponding lower projections are 30 million cubic feet or 45 million linear feet. About 90 percent is expected to be softwood and 10 percent hardwood.

Poles

Wood poles are used principally for electric power, telephone, and telegraph lines. The number of poles in service has been increasing and is expected to increase still further. The most rapid increase has been in the power-line field:

	Million poles in service	
Class of utility:	*1938*	*1949*
Rural electric cooperatives	0. 7	15. 0
Other power lines	19. 5	32. 2
Telephone lines	21. 0	25. 2
Western Union telegraph	8. 8	9. 7
Class I railroads	2. 6	4. 2
Total	52. 6	86. 3

The average annual number of poles installed has increased from 3.6 million in the period 1923–29 to 6.8 million in 1946–50. In 1952, 6.5 million poles were installed.

Because of the great mileage of new power lines installed during recent years, the recent trend in the number of poles installed annually is not considered a very reliable indicator of what future demand might be. However, in view of anticipated increases in population and gross national product, it seems logical to expect that it will be necessary to install a considerable mileage of new lines each year. Assuming that new lines being constructed will require an average of 2 million poles annually and that there will be 140 million poles in service in 1975 with an average service life of about 30 years, medium projected demand for poles in 1975 amounts to 6.5 million poles. (The number would provide 4.5 million poles for replacements and 2 million for new lines.) Lower projected demand is estimated at 4.9 million. Nearly all poles used in the future will probably be softwoods.

Fence Posts

Wood fence posts are used chiefly in farm fences. Use in safety barricades on highways is an important secondary source of demand. Consumption has declined sharply in the past 35 years according to Forest Service estimates:

	Posts used (millions)
1920	900
1929	400
1937	475
1945	250
1952	306

The decline in use of fence posts has resulted partly from greater use of steel and concrete posts, and partly from increased use of wood preservatives. Farm abandonment, farm consolidation, and decline in use of horses on farms are additional factors that have tended to reduce post consumption. The influence of such factors is currently being partially offset by farm reorganization for soil conservation, more intensive pasture management, rangeland improvement, and new highway construction.

Medium projected demand for fence posts in 1975 is estimated at 400 million pieces or about 31 percent more than consumption in 1952. Lower projected demand is judged to be 337 million. Of these totals, about 35 percent may be softwoods and 65 percent hardwoods.

Hewn Ties

The hewn-tie portion of tie production has decreased very rapidly in the past 50 years. Since 1947 the number of hewn ties reported treated has decreased from 12.7 million to 2.0 million in 1955. With the production of hewn ties already down to an estimated 2.5 million in 1955, it can be expected that production of hewn ties will have ceased entirely before 1975 and that all crossties will be of the sawed variety.

Round Mine Timbers

Trends in consumption of round mine timbers and factors affecting consumption are the same as those discussed previously in connection with lumber used in mining construction. Medium projected demand for round mine timbers is estimated at 105 million cubic feet in 1975, or 30 percent above the estimated consumption of 81 million cubic feet in 1952. Lower projected demand is estimated at 87 million cubic feet in 1975.

Other Industrial Wood

An estimated 227 million cubic feet of timber were used in 1952 for a wide variety of products such as charcoal and other wood distillation products, spools, dowels and other turned products, shingles, excelsior, sporting goods, smelter poles, farm poles, and round and split farm timber. (Not included in these estimates are substantial quantities of dead chestnut wood used for tannin extract and of pine stumps used for naval stores.)

Past trends in consumption have been variable. Use of wood shingles, excelsior, and charcoal has

been on the downgrade, but use of many of the manufactured products made directly from bolts has been increasing. Assuming that the heavier market losses for wood in these miscellaneous uses have already been sustained, 1975 demand is estimated at 350 million cubic feet or 54 percent above 1952 consumption. Lower projected demand is set at 314 million cubic feet. About half of either estimate is expected to be softwood.

Projections of Demand for All Minor Industrial-Wood Products

The various estimates of medium projected demand for the minor industrial-wood products in 1975 add up to 913 million cubic feet (roundwood basis), about 20 percent above 1952 consumption of 758 million cubic feet. Comparable medium and upper projections of demand in 2000 are 1,450 and 1,740 million cubic feet or 59 and 91 percent, respectively, above the 1975 estimate. The lower projection totals 770 million cubic feet in 1975 and the estimate for 2000 is 1,160 million cubic feet—51 percent above 1975 (table 263). The projections to 2000 are based on the assumptions that most of the market losses by products most vulnerable to competition will have occurred by 1975, and that the increase of population and other factors will materially enlarge the demand for some products in the last quarter century.

Minor industrial-wood products consumed in 1952 were divided about equally between softwoods and hardwoods. It is expected that this relationship will remain essentially unchanged in the future.

FUTURE DEMAND FOR FUELWOOD

Because fuelwood is drawn from so many different sources, any single figure cited as "fuelwood consumption" or projected demand for fuelwood is likely to lead to some confusion. Furthermore, there is a possibility of confusion with respect to wood used for fuel by industrial and other nonresidential establishments. Some estimates in the past have included such wood and others have not. The figures presented in this section for total fuelwood consumption, and projections of demand, do include that used by nonresidential establishments as well as that used in homes, whether cut purposely for fuel or obtained from sawmills and other primary manufacturing plants in the form of residues.

The large drop in fuelwood consumption during the past few decades in spite of a substantial increase in population has been due to greater use of more convenient and efficient fuels such as coal, oil, gas, and electricity. Use of wood for curing tobacco and in certain industries such as brickyards has declined sharply because other fuels have been substituted. Since 1941 the decline in use of fuelwood in homes has been particularly rapid as the result of changes in both heating and cooking fuels. Between 1940 and 1950, for example, the percentage of occupied dwelling units using wood for central heating or for cooking dropped from over 20 to less than 10 percent of the total. This decline occurred in farm and rural areas as well as in cities.

Consumption of fuelwood in homes will probably decline still further as a result of such factors as increased use of electricity and bottled gas in rural

Table 263.—*Estimated consumption of minor industrial wood products, 1952, and projections of demand, 1975 and 2000*

[Roundwood basis]

Product	1952 consumption	Projections of demand: 1975 Lower	1975 Medium	2000[1] Lower	2000[1] Medium	2000[1] Upper
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Cooperage logs and bolts	73	97	109			
Piling	28	30	37			
Poles	88	67	88			
Posts (round and split)	194	175	224			
Hewn ties	67					
Mine timbers (round)	81	87	105			
Other minor products	227	314	350			
All minor industrial products [2]	758	770	913	1, 160	1, 450	1, 740

[1] Not allocated to product.

[2] Includes volume of products recovered from plant residues. Thus for 1952, the 758 million cubic feet includes 699 million cubic feet of logs and bolts used for these minor products and 59 million cubic feet (roundwood equivalent) of plant residue.

areas, greater use of modern heating equipment, increased urbanization, and increased per capita income.

Use of wood for production of steam power in primary wood-using plants is likewise expected to decline considerably, partly because of greater use of plant residues for fiber products rather than for fuel, and partly because more and more small mills are converting from steam power to internal combustion engines.

Fuelwood is rapidly becoming a byproduct of timber cut for industrial-wood products. In 1952, an estimated 58.6 million cords of wood were used for fuel, including 31.4 million cords taken from plant residues. In view of this situation and the comparatively weak position of fuelwood in competition with other energy materials, only a single estimate is made for 1975 and also for 2000. These serve in lieu of separate lower, medium, and upper projections of demand:

Source:	1952 consumption (million cords)	Projected demand: 1975 (million cords)	Projected demand: 2000 (million cords)
Mill residues	31. 4	22. 9	18. 0
Roundwood	27. 2	11. 1	7. 0
Total	58. 6	34. 0	25. 0

It is estimated that by 1975 the demand for fuelwood will have decreased by about 42 percent below 1952 consumption and by 2000, 58 percent. Residues account for an increasingly greater share of the total ranging from 54 percent in 1952 to 67 percent in 1975 and 72 percent in 2000. More than three-fourths of the roundwood is estimated to be hardwoods, while three-fourths of the residues are estimated to be softwoods.

UNITED STATES INTERNATIONAL TRADE IN TIMBER PRODUCTS

Although the United States ranks first among the nations of the world as a producer of timber products, it is also one of the leading importers of such products. The principal items imported include lumber, pulpwood, woodpulp, newsprint and other paper and paperboard, veneer, plywood, and veneer logs and bolts.

Various timber products such as poles, piling, shingle bolts, hewn ties, and many other items regularly enter the international trade of the United States. The quantities involved have always been small and are not expected to become important in the future.

In terms of roundwood and roundwood-equivalent volume, pulpwood and products of pulpwood comprised about 74 percent of total imports in 1952 and about 64 percent in 1955. Lumber is next in volume imported, comprising 23 percent of total net imports in 1952 and 33 percent in 1955.

About 91 percent of the lumber, 96 percent of the paper and paperboard, 81 percent of the woodpulp, and a high percentage of the imports of other timber products come from Canada (table 264).

United States exports of timber products are comparatively small, being only about one-fifth as much as the volume imported. Exports consist chiefly of lumber, woodpulp, and paper, and go to all parts of the world, although Canada and Mexico are the principal markets.

Total trade in 1952 and 1955 measured in

TABLE 264.—*United States imports of timber products by source, 1952 and 1955*

Product	Standard unit of measure	1952			1955		
		Quantity	Percent from Canada	Percent from other countries	Quantity	Percent from Canada	Percent from other countries
Lumber	Million bd.-ft	2, 487	91	9	3, 599	93	7
Softwoods	do	2, 267	94	6	3, 327	97	3
Hardwoods	do	215	55	[1] 45	266	47	[1] 53
Pulpwood	Thousand cords	2, 310	99		1, 928	99	
Woodpulp	Thousand tons	1, 941	81	19	2, 213	84	16
Paper and paperboard	do	5, 191	96	5	5, 383	96	4
Plywood	Million sq. ft	86	67	34	628	16	[2] 84
Veneer	do	428	94	6	765	88	12
Saw logs and veneer logs	Million bd.-ft	191	66	[1] 34	199	46	[1] 54

[1] Includes the tropical hardwoods imported chiefly from the Philippines, Latin America, and Africa.

[2] In 1955 Japan was the major source of plywood imports—supplying 68 percent of the total.

Source: U. S. Department of Commerce, Bureau of the Census.

roundwood and roundwood-equivalent volume was as follows:

	Million cubic feet		
	Imports	Exports	Net imports
1952	1, 390	214	1, 176
1955	1, 626	315	1, 311

Trends in Lumber Imports and Exports

Lumber has been a substantial item in the international trade of this country since colonial times. Prior to 1941, exports exceeded imports, but since that year (excepting 1947) imports have exceeded exports (table 265).

The bulk of the trade has been softwoods—more than 90 percent of total imports during most years since 1923, and from 70 to 85 percent of the exports. In 1955, the principal softwoods imported were spruce, Douglas-fir, cedar, white pine, hemlock, and larch:

Species:	Million bd.-ft.	Percent
Spruce	1, 167	35
Douglas-fir	983	30
Cedar	285	8
Pine	247	7
Hemlock	192	6
Not specified	453	14
Total	3, 327	100

Most of the imported softwood lumber has come from Canada. In 1955, for example, more than 97 percent was from this source (table 264). Small quantities of Parana pine have been imported from Brazil and some softwood was obtained from Mexico in the early 1940's, but such imports have declined to a mere trickle in more recent years. The comparatively small volume of hardwood lumber imported consists chiefly of maple, birch, and beech from Canada and a variety of tropical hardwoods such as teak, mahagony, rosewood, ebony, and granadilla, chiefly from the Philippines, Latin America, and Africa.

Shipments of lumber from the United States have gone to all parts of the world. Formerly the largest share went to Europe, particularly to the United Kingdom; the rest went to Latin American, Asian, and African countries. In most recent years a sizable share has been going to Canada and Mexico.

Softwood has made up 70 to 85 percent of annual lumber exports since 1923. Douglas-fir and southern pine have been the two major species. Smaller quantities of the other pines and of spruce, redwood, hemlock, and cypress have been shipped abroad. The bulk of the hardwood export has been oak, with lesser amounts of gum, ash, poplar, and other species.

Although the United States international trade in lumber has involved substantial quantities, it has been of relatively minor importance in comparison with domestic production and consumption (table 266 and fig. 130). In the period 1951–52, for example, domestic production averaged 37.4 billion board-feet while imports averaged 2.5 billion board-feet and exports 0.8 billion board-feet.

The general pattern of international trade in lumber shows the United States changing from a net exporting to a net importing country after 1941 (fig. 131). Since that time tariffs and other restrictions on United States imports have been reduced, and domestic demand for lumber has been at a high level. During World War II the lack of transportation and other factors associated with the war caused a loss of United States export markets. Subsequently, many of the countries that formerly received lumber from the United States have found it necessary to limit their purchases because of currency-exchange problems. The effect of these factors is that the United States has become a net importing nation and appears likely to remain so in the foreseeable future.

The United States has assumed a leading role in the cooperative efforts of the Free World to strengthen the economic security and to foster the economic growth of underdeveloped countries. It therefore seems logical to expect that the United States will be called upon to supply quantities of lumber required in this program. In looking to the future it has been assumed that the United States will make some increases in lumber exports, but that its own expanding economy will, at the same time, require increasingly larger lumber imports.

As the timber resources of Canada become more fully developed, it is reasonable to expect that the United States can count on some increases in lumber imports from that source. On this basis, it is estimated that our net imports (the difference between imports and exports) may amount to 3 billion board-feet in 1975 and 2000. Although this figure is only slightly above net lumber imports in 1955, it is 43 percent greater than the 1951–55 average of 2.1 billion board-feet and 71 percent more than net imports in 1952. Distribution by softwoods and hardwoods is expected to follow the pattern of recent years as shown below:

	Million bd.-ft.		
	Total	Softwood	Hardwood
1952	1, 752	1, 701	51
1955	2, 755	2, 675	80
1975	3, 000	2, 900	100
2000	3, 000	2, 900	100

Trends in Imports and Exports of Pulpwood and Pulpwood Products

In United States international trade in pulpwood and pulpwood products, imports have far exceeded exports in recent years. Exports of pulp.

TABLE 265.—*Lumber production, imports, and exports, by softwoods and hardwoods, selected years, 1899–1955*

[Million board-feet]

Year	Production [1]			Imports [2]				Exports [2]			
	Total	Soft-woods	Hard-woods	Total	Soft-woods	Hard-woods	Mixed	Total	Soft-woods	Hard-woods	Mixed
1899*	35, 078	26, 371	8, 706	424				1, 411			
1900				680				1, 561			
1901				491				1, 667			
1902				666				1, 393			
1903				721				1, 643			
1904	43, 000	32, 538	10, 462	589				2, 046			
1905	43, 500	32, 960	10, 540	711				1, 817			
1906	46, 000	34, 900	11, 100	950				1, 926			
1907	46, 000	34, 946	11, 054	934				2, 260			
1908	42, 000	31, 945	10, 055	791				2, 039			
1909*	44, 510	33, 897	10, 613	846				1, 763			
1910	44, 500	34, 029	10, 471	1, 054				2, 162			
1911	43, 000	33, 020	9, 980	872				2, 561			
1912	45, 000	34, 695	10, 305	905				2, 748	2, 027	305	416
1913	44, 000	34, 065	9, 935	1, 092		1	1, 091	3, 053	2, 394	410	249
1914	40, 500	31, 481	9, 019	931		7	925	2, 829	2, 275	333	221
1915	37, 012	29, 485	7, 527	941		12	929	1, 303	1, 067	142	94
1916	39, 807	31, 332	8, 475	1, 218		18	1, 200	1, 369	1, 119	155	95
1917	35, 831	29, 174	6, 657	1, 175		10	1, 166	1, 219	1, 024	81	114
1918	31, 890	25, 668	6, 223	1, 209		3	1, 206	1, 093	903	190	0
1919*	34, 552	27, 407	7, 145	1, 149		5	1, 144	1, 486	1, 112	373	0
1920	35, 000	27, 610	7, 390	1, 351		12	1, 339	1, 712	1, 496	215	0
1921	29, 000	23, 444	5, 556	839		9	831	1, 338	1, 192	146	0
1922	35, 250	28, 922	6, 328	1, 564	529	24	1, 010	1, 953	1, 632	250	71
1923	41, 000	33, 220	7, 780	1, 971	1, 868	103	0	2, 466	2, 081	316	68
1924	39, 500	31, 549	7, 951	1, 743	1, 657	86	0	2, 748	2, 320	346	82
1925	41, 000	33, 283	7, 716	1, 846	1, 735	112	0	2, 612	2, 194	373	45
1926	39, 750	32, 078	7, 672	1, 899	1, 777	123	0	2, 826	2, 424	362	41
1927	37, 250	29, 976	7, 275	1, 745	1, 634	111	0	3, 063	2, 609	418	36
1928	36, 750	29, 853	6, 898	1, 468	1, 372	96	0	3, 244	2, 739	484	21
1929	38, 745	30, 836	7, 909	1, 543	1, 418	124	0	3, 197	2, 698	480	19
1930	29, 358	23, 228	6, 130	1, 219	1, 148	40	31	2, 352	1, 912	418	23
1931	19, 997	15, 887	4, 111	749	702	25	22	1, 701	1, 353	334	14
1932	13, 524	10, 802	2, 722	381	352	15	14	1, 156	911	241	4
1933	17, 151	13, 786	3, 365	359	309	27	23	1, 281	987	294	1
1934	18, 826	14, 618	4, 208	287	244	22	21	1, 349	1, 063	284	2
1935	22, 944	18, 196	4, 748	438	380	58	0	1, 313	1, 003	307	3
1936	27, 626	22, 025	5, 601	662	570	92	0	1, 284	947	335	2
1937	29, 004	23, 148	5, 856	688	573	114	1	1, 443	1, 056	384	3
1938	24, 825	19, 955	4, 871	530	459	70	1	977	710	266	2
1939	28, 755	23, 291	5, 464	718	606	102	11	1, 104	828	254	22
1940	31, 159	25, 622	5, 537	740	607	117	16	972	748	168	56
1941	36, 538	29, 867	6, 671	1, 361	1, 183	167	11	693	509	146	38
1942*	36, 332	29, 510	6, 822	1, 540	1, 397	114	30	463	285	96	82
1943*	34, 289	26, 917	7, 371	856	704	135	16	310	201	76	32
1944*	32, 938	25, 160	7, 778	1, 000	819	159	22	360	234	96	29
1945*	28, 122	21, 140	6, 982	1, 063	882	164	17	435	289	117	30
1946*	34, 112	25, 857	8, 256	1, 239	1, 020	206	13	649	518	98	33
1947*	35, 404	27, 937	7, 467	1, 311	1, 092	213	5	1, 352	972	186	193
1948	37, 000	29, 600	7, 400	1, 880	1, 652	217	11	647	462	88	97
1949*	32, 176	26, 472	5, 704	1, 574	1, 425	138	12	667	534	133	0
1950*	38, 007	30, 633	7, 374	3, 432	3, 140	283	9	517	407	110	0
1951*	37, 204	29, 493	7, 711	2, 517	2, 260	249	9	998	876	122	0
1952*	37, 462	30, 234	7, 228	2, 487	2, 267	215	5	735	566	162	7
1953*	36, 742	29, 562	7, 180	2, 771	2, 527	233	11	644	513	130	(3)
1954*	36, 356	29, 282	7, 074	3, 066	2, 855	209	3	723	585	133	5
1955	39, 000	31, 200	7, 200	3, 599	3, 327	266	6	844	652	189	3

[1] As estimated by the Forest Service, except for years marked by an asterisk. Data for those years are from the Bureau of the Census.

[2] Import and export data are for fiscal years up to 1918 and for calendar years thereafter.

[3] Less than 0.5 million.

Source: Lumber production: U. S. Department of Agriculture, Forest Service, and U. S. Department of Commerce, Bureau of the Census. Lumber imports and exports: U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce and Bureau of the Census.

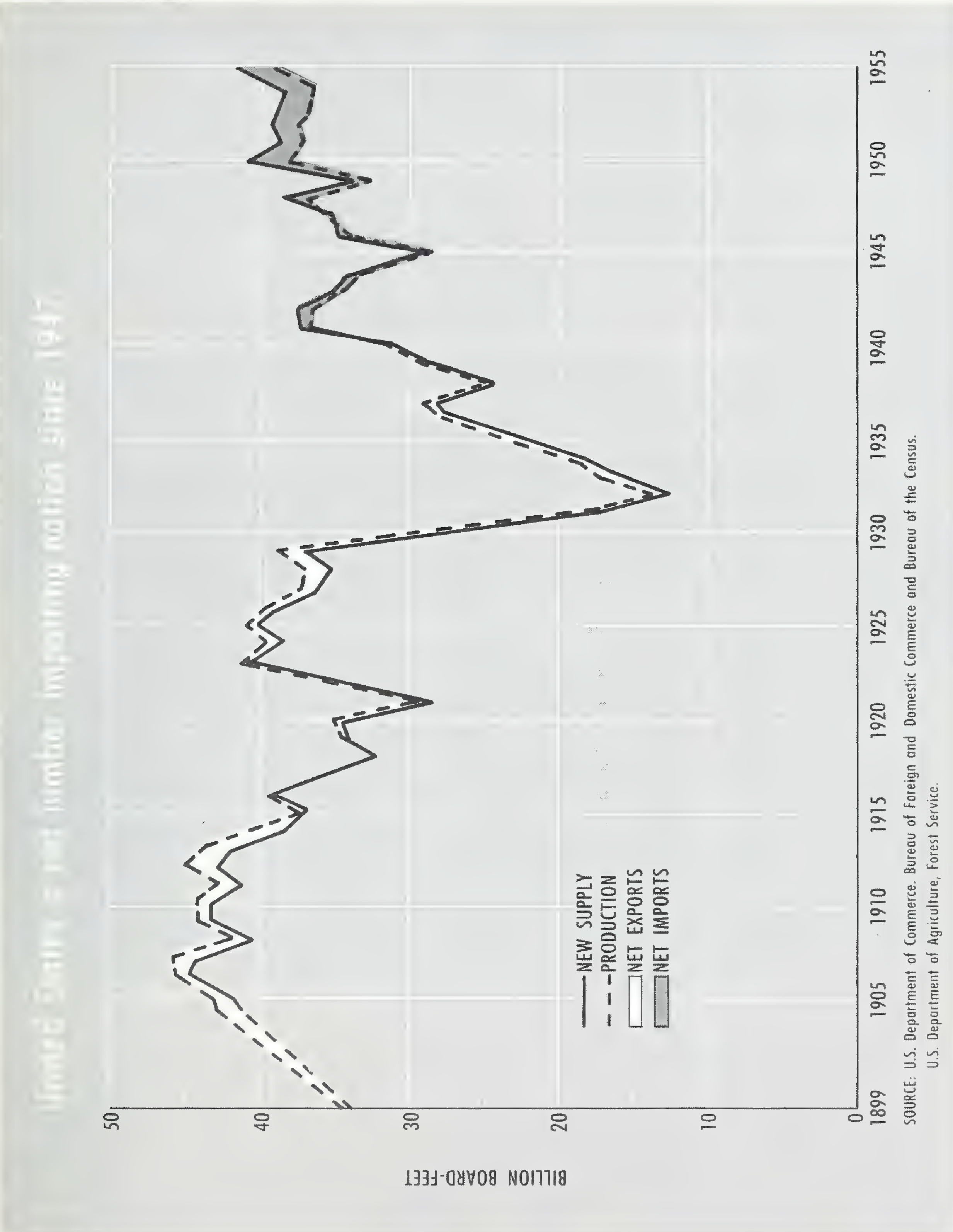

BILLION BOARD-FEET
0
10
20
30
40
50
1899
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
NEW SUPPLY
PRODUCTION
NET EXPORTS
NET IMPORTS
SOURCE: U.S. Department of Commerce. Bureau of Foreign and Domestic Commerce and Bureau of the Census.
U.S. Department of Agriculture, Forest Service.

Figure 139

TABLE 266.—*New supply of lumber in the United States, 1899–1955*

[Million board-feet]

Year	Production [1]	Net exports [2]	Net imports [2]	New supply	Year	Production [1]	Net exports [2]	Net imports [2]	New supply
1899*	35,078	987		34,091	1928	36,750	1,776		34,974
1900	(3)	881			1929	38,745	1,654		37,091
1901	(3)	1,176			1930	29,358	1,133		28,225
1902	(3)	727			1931	19,997	952		19,045
1903	(3)	922			1932	13,524	775		12,749
1904	43,000	1,457		41,543	1933	17,151	922		16,229
1905	43,500	1,106		42,394	1934	18,826	1,062		17,764
1906	46,000	976		45,024	1935	22,944	875		22,069
1907	46,000	1,326		44,674	1936	27,626	622		27,004
1908	42,000	1,248		40,752	1937	29,004	755		28,249
1909*	44,510	917		43,593	1938	24,825	447		24,378
1910	44,500	1,108		43,392	1939	28,755	386		28,369
1911	43,000	1,689		41,311	1940	31,159	232		30,927
1912	45,000	1,843		43,157	1941	36,538		668	37,206
1913	44,000	1,961		42,039	1942*	36,332		1,077	37,409
1914	40,500	1,898		38,602	1943*	34,289		546	34,835
1915	37,012	362		36,650	1944*	32,938		640	33,578
1916	39,807	151		39,656	1945*	28,122		628	28,750
1917	35,831	44		35,787	1946*	34,112		590	34,702
1918	31,890		116	32,006	1947*	35,404	41		35,363
1919*	34,552	337		34,215	1948	37,000		1,233	38,233
1920	35,000	361		34,639	1949*	32,176		907	33,083
1921	29,000	499		28,501	1950*	38,007		2,915	40,922
1922	35,250	389		34,861	1951*	37,204		1,519	38,723
1923	41,000	495		40,505	1952*	37,462		1,752	39,214
1924	39,500	1,005		38,495	1953*	36,742		2,127	38,869
1925	41,000	766		40,234	1954*	36,356		2,343	38,699
1926	39,750	927		38,823	1955	39,000		2,755	41,755
1927	37,250	1,318		35,932					

[1] As estimated by the Forest Service, except for years marked by an asterisk. Data for those years are from the Bureau of the Census.

[2] Import and export data are for fiscal years up to 1918 and for calendar years thereafter.

[3] Data not available.

Source: Lumber production: U. S. Department of Agriculture, Forest Service, and U. S. Department of Commerce, Bureau of the Census. Lumber imports and exports: U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce and Bureau of the Census.

wood, woodpulp, and newsprint represent only a token of the volume of such products imported. Exports of paper other than newsprint and paperboard have been somewhat in excess of imports, but because of the small quantity involved they play a relatively minor role in United States international trade in timber products.

Imports of Pulpwood Logs and Bolts Far Exceed Exports

The United States international trade in pulpwood logs and bolts has consisted almost entirely of imports, but exports have been taken into account in the net import estimates:

Year:	Cords (thousand)	Year:	Cords (thousand)
1899	369	1935	1,037
1905	645	1940	1,374
1910	948	1945	1,688
1914	830	1950	1,807
1920	1,100	1952	2,293
1925	1,088	1955	1,868
1930	1,096		

These net imports of logs and bolts comprised about 20 percent of the 1952 total net import (roundwood equivalent) of pulpwood and pulpwood products. In 1955 they represented about 18 percent. Nearly all imports of pulpwood logs and bolts have come from Canada.

Canadian policy discourages the export of unmanufactured wood products. The effect of that policy in the future is difficult to assess. In view of all circumstances, it is expected that imports of pulpwood logs and bolts from Canada in 1975 and 2000 will not exceed a million cords per year.

Most Woodpulp Imports Come From Canada

United States imports of woodpulp also exceed exports by a large margin (table 267). Expressed in terms of wood equivalent, the net imports of woodpulp reached an alltime high of 4,158 thousand cords in 1950. But from that level they declined

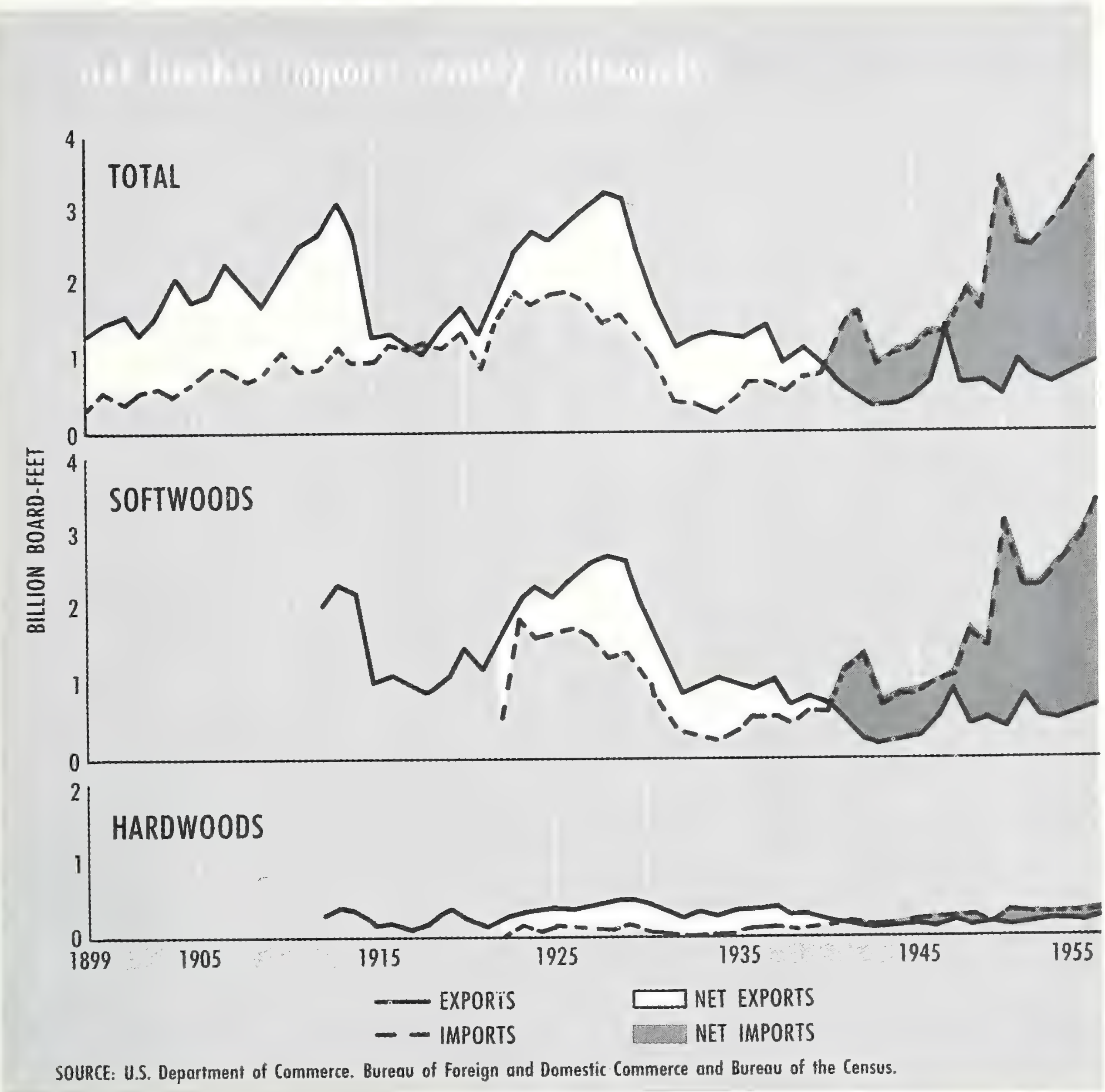


Figure 131

to 3,105 thousand in 1952 and dropped still further to 2,755 thousand in 1955. These net imports of woodpulp comprised about 28 percent of both 1952 and 1955 total net imports of pulpwood and pulpwood products (roundwood equivalent).

During recent years Canada has supplied between 80 and 85 percent of the woodpulp imported by the United States. The rest originates in the Scandinavian countries. In the 1930's, the situation was just the opposite: at that time up to 70 percent in some years came from Scandinavia and 30 percent from Canada. Unless western Europe begins to draw heavily on the Soviet Union for its future supplies of woodpulp, it is not likely that any large quantity of woodpulp will flow again from Scandinavia to the United States. The west European market will probably take about all the woodpulp that can be produced in that area.

With regard to continued imports of woodpulp from Canada, the outlook is favorable. However, it is expected that 1975 and 2000 net imports of woodpulp will not exceed the peak level reached in 1950, about 4 million cords (wood equivalent).

TABLE 267.—*United States international trade in woodpulp, specified years, 1899–1955*

Year	Imports	Exports	Net imports	
			As woodpulp	As pulpwood equivalent [1]
	Thousand tons	*Thousand tons*	*Thousand tons*	*Thousand cords*
1899	57	21	36	56
1904	179	10	169	261
1909	370	9	361	560
1914	676	12	664	1, 028
1920	906	32	874	1, 561
1925	1, 664	38	1, 626	2, 899
1930	1, 830	48	1, 782	3, 238
1935	1, 933	172	1, 761	3, 252
1940	1, 225	481	744	1, 306
1945	1, 754	135	1, 619	2, 971
1950	2, 385	96	2, 289	4, 158
1952	1, 941	212	1, 729	3, 105
1955	2, 213	633	1, 580	2, 755

[1] Converted on the following basis:
1 ton sulfite pulp = 2.05 cords
1 ton sulfate pulp = 1.78 cords
1 ton soda pulp = 2.10 cords
1 ton groundwood pulp = 1.01 cords
1 ton other pulp = 1.02 cords

Source: U. S. Department of Commerce, Bureau of the Census; U. S. Department of Agriculture, Forest Service; and United States Pulp Producers Association, *Wood Pulp Statistics*, reporting statistics of the Bureau of the Census.

Bulk of Paper and Paperboard Imports Is Newsprint

In the early 1900's exports of paper and paperboard exceeded imports, but since 1914 the United States has been a net importing nation (table 268). Excepting some fluctuation during war and depression years, net imports have increased steadily from 296 thousand cords (roundwood equivalent volume) in 1914 to about 6 million cords in 1950–55.

In 1952, net imports of paper and paperboard (roundwood equivalent) comprised 52 percent of the net imports of pulpwood and pulpwood products. In 1955 they represented 54 percent of the total.

In nearly all years since 1914 the United States has been a net exporter of most grades of paper and paperboard. Newsprint has comprised the bulk of imports and a substantial part of the exports. The 1955 distribution of paper and paperboard imports and exports by major grade classes is shown below:

Grade class:	*Imports* (Thousand tons)	*Exports*	*Net imports*	*Net exports*
Newsprint	5, 159	207	4, 952	---
Other paper	112	316	-----	204
Paperboard	112	322	-----	210
Total	5, 383	845	4, 952	414

Canada has supplied nearly all of the newsprint (97 percent in 1955) imported. Small quantities of newsprint and specialty grades of paper have originated in Sweden, Norway, and Finland.

Imports of Canadian newsprint have supplied a large part (more than 80 percent since 1946) of the newsprint consumed in the United States. The dependence of the United States upon Canadian newsprint imports has been due to a number of factors, including: (a) The depletion of the long-fibered softwood pulpwood supplies in New England and the Lake States, (b) lack of tariff protection,[155] and (c) the rapidly rising demand for other grades of paper and paperboard, which domestic manufacturers considered more profitable to produce.

TABLE 268.—*United States international trade in paper and paperboard, specified years, 1899–1955*

Year	Imports	Exports	Net imports	
			As paper and paperboard	As pulpwood equivalent [1]
	Thousand tons	*Thousand tons*	*Thousand tons*	*Thousand cords*
1899	6	57	[2] 51	[2] 76
1904	10	57	[2] 47	[2] 70
1909	35	48	[2] 13	[2] 15
1914	316	83	233	296
1920	787	285	502	565
1925	1, 542	130	1, 412	1, 785
1930	2, 347	206	2, 141	2, 754
1935	2, 344	173	2, 171	2, 930
1940	2, 816	551	2, 265	2, 977
1945	2, 753	459	2, 294	2, 912
1950	5, 007	372	4, 635	5, 874
1952	5, 191	592	4, 599	5, 838
1955	5, 383	845	4, 538	5, 836

[1] Converted on the following basis:
1 ton newsprint = 1.27 cords
1 ton other paper = 1.50 cords
1 ton paperboard = .69 cords

[2] Net exports.

Source: U. S. Department of Commerce, Bureau of the Census; U. S. Department of Agriculture, Forest Service; and American Pulp and Paper Association, *The Statistics of Paper*, reporting statistics of the Bureau of the Census.

[155] In 1911 as a result of the Canadian Reciprocity Act, the tariff on newsprint was abolished. Tariffs on other grades of paper were retained.

Anticipated Net Import Position in 1975 and 2000

With regard to pulpwood products as a whole, the United States has been a net importer since before 1900 (table 269). Net imports increased with hardly a pause from the equivalent of 0.3 million cords in 1899 to 7.5 million cords in 1929. Following some cutbacks in the depression years of the early 1930's and again at the outbreak of World War II, which shut off supplies from Europe, net imports resumed their climb—reaching a peak of 12.3 million cords in 1951. Net imports declined moderately thereafter to about 11.2 million cords in 1952 and 10.5 million cords in 1955.

The net imports of pulpwood and pulpwood products in 1952 accounted for about 74 percent of United States net imports (roundwood equivalent) of timber products. They represented about 32 percent of total United States consumption of pulpwood products in 1952—and about 9 percent of total United States consumption (roundwood equivalent) of industrial wood.

Close to 95 percent (10.6 million cords) of 1952 net imports of pulpwood and pulpwood products came from Canada. The rest came from Scandinavian countries.

Table 269.—*United States net imports of pulpwood and pulpwood products*

[Thousand standard cords]

Year	Quantity [1]	Year	Quantity [1]	Year	Quantity [1]
1899	349	1923	5, 320	1940	5, 647
1904	765	1924	5, 474	1941	7, 079
1905	828	1925	5, 772	1942	7, 142
1906	944	1926	6, 617	1943	6, 486
1907	1, 283	1927	6, 679	1944	6, 022
1908	1, 022	1928	7, 134	1945	7, 571
1909	1, 339	1929	7, 486	1946	9, 251
1910	1, 728	1930	7, 088	1947	10, 602
1911	1, 791	1931	6, 090	1948	11, 376
1914	2, 154	1932	5, 596	1949	10, 158
1916	2, 211	1933	6, 277	1950	11, 839
1917	2, 129	1934	6, 569	1951	12, 273
1918	2, 060	1935	7, 219	1952	11, 236
1919	2, 306	1936	8, 439	1953	11, 170
1920	3, 226	1937	9, 391	1954	10, 203
1921	2, 881	1938	6, 949	1955	10, 459
1922	4, 523	1939	7, 652		

[1] In terms of roundwood equivalent volume. Factors used for conversion of tonnages of woodpulp and of paper and paperboard to roundwood equivalent volume are shown in footnotes to tables 267 and 268 above.

Source: U. S. Department of Commerce, Bureau of the Census; U. S. Department of Agriculture, Forest Service; and American Pulp and Paper Association, *The Statistics of Paper*, reporting statistics of the Bureau of the Census.

Net imports of paper and paperboard, woodpulp, and pulpwood in 1955 and anticipated net imports in 1975 and 2000 are summarized as follows:

	Roundwood equivalent volume (million cords)		
	1955	*1975*	*2000*
Paper and paperboard	5. 8	9. 0	10. 0
Woodpulp	2. 8	4. 0	4. 0
Pulpwood	1. 9	1. 0	1. 0
Total	10. 5	14. 0	15. 0

The estimates imply that total net imports of pulpwood, including the pulpwood equivalent of paper and woodpulp imports, will increase 35 percent and 44 percent respectively by 1975 and 2000. It is estimated that about two-thirds would be in the form of newsprint and other paper, and most of the remainder in the form of woodpulp. More than 90 percent would be softwoods.

Trends in Imports and Exports of Veneer Logs and Bolts and Veneer Products

Prior to about 1947, exports of veneer and plywood exceeded imports. Since that time the position has been reversed, and exports now make up only a small fraction of the volume imported. About the same situation exists with respect to veneer logs and bolts, except that the changeover occurred about 10 years earlier. At present veneer logs and bolts are relatively minor items in United States international trade in timber products.

Plywood Imports Mostly Hardwood

Imports of plywood amounted to about 4.5 million square feet in 1937 but declined thereafter, particularly during World War II (table 270 and fig. 132). After the war, imports increased to several times the prewar level, but the total quantities remained small until after 1949. Since then imports have increased sharply, rising from 63 million square feet in 1950 to 628 million square feet in 1955.

Hardwood plywood has comprised more than 90 percent of plywood imports since 1950. About 68 percent of plywood imports in 1955 originated in Japan, 16 percent in Canada, and the remaining 16 percent in Finland, the Philippines, French Equatorial Africa, Mexico, and various other countries. The imports from Japan consisted predominantly (some 80 percent or more) of the tropical wood known as luan. Nearly all of the imports from Canada were birch. Plywood imported from other countries included a variety of species—oak, poplar, beech, mahogany, and some softwoods.

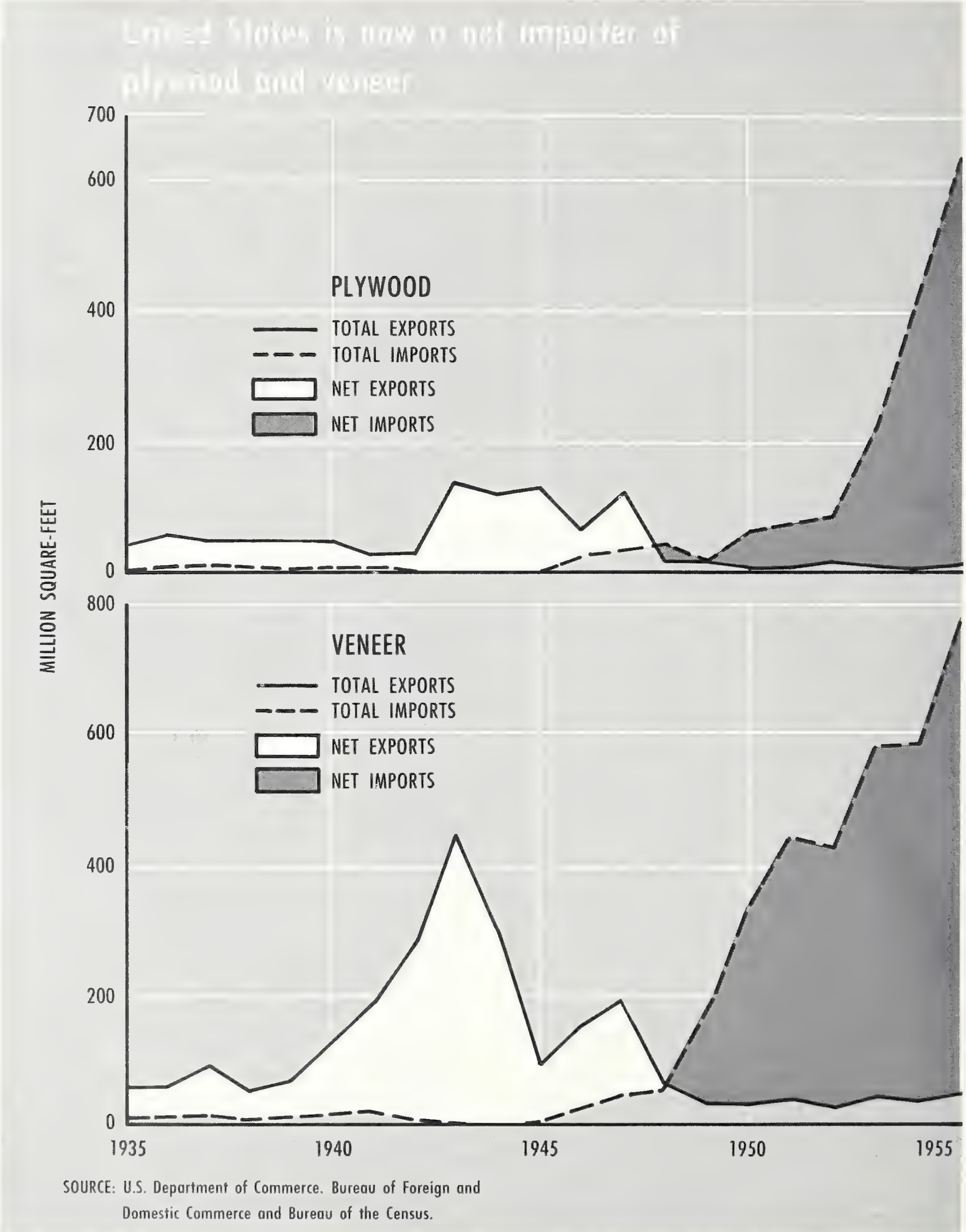

United States is now a net importer of plywood and veneer
PLYWOOD
TOTAL EXPORTS
TOTAL IMPORTS
NET EXPORTS
NET IMPORTS
VENEER
TOTAL EXPORTS
TOTAL IMPORTS
NET EXPORTS
NET IMPORTS
MILLION SQUARE-FEET
700
600
400
200
0
800
600
400
200
0
1935
1940
1945
1950
1955
SOURCE: U.S. Department of Commerce. Bureau of Foreign and Domestic Commerce and Bureau of the Census.

Figure 132

TABLE 270.—*Exports and imports of plywood by kinds, 1935–55*

[Thousand square feet]

Year	Exports			Imports		
	Total	Soft-woods	Hard-woods [1]	Total	Birch	Other [2]
1935	40, 845	------	-------	30	0	30
1936	59, 484	56, 874	2, 610	678	40	638
1937	47, 148	45, 289	1, 859	4, 532	608	3, 924
1938	-------	------	-------	2, 878	1, 641	1, 237
1939	-------	------	-------	2, 859	1, 441	1, 418
1940	45, 234	------	45, 234	2, 623	612	2, 011
1941	24, 921	------	24, 921	3, 470	636	2, 834
1942	27, 746	------	27, 746	222	11	211
1943	135, 967	------	135, 967	9	4	5
1944	117, 834	------	117, 834	1	0	1
1945	127, 115	69, 692	57, 423	788	605	183
1946	60, 935	29, 232	31, 703	24, 380	18, 162	6, 218
1947	118, 448	49, 820	68, 628	37, 151	23, 318	13, 833
1948	14, 305	12, 659	1, 646	42, 392	18, 890	23, 502
1949	16, 060	16, 060	-------	19, 720	16, 204	3, 516
1950	3, 816	3, 279	[3] 537	63, 262	51, 221	12, 041
1951	4, 551	3, 916	635	73, 870	50, 428	23, 442
1952	13, 460	13, 095	365	85, 500	62, 171	23, 329
1953	10, 273	9, 648	625	220, 846	90, 120	130, 726
1954	7, 335	6, 682	653	434, 472	110, 149	326, 553
1955	10, 352	8, 122	2, 230	627, 760	156, 579	471, 181

[1] For the years 1953–55, includes nonwood-faced plywood and other types of boards in the following amounts: 1952, 105; 1953, 162; 1954, 222; 1955, 1,906.

[2] Includes 22, 37, and 32 thousand square feet of birch and alder in 1935, 1936, and 1937, respectively, and 3,974 and 154 thousand square feet of western redcedar in 1948 and 1949, respectively.

[3] For 1950, hardwood includes "special" plywood—172,000 sq. ft.

Source: U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce and Bureau of the Census.

Although exports of plywood were comparatively large during World War II (136 million square feet in 1943), they have generally not been significant in other years. In 1955 they totaled about 10 million square feet—about 2 percent of the volume of imports. Most of the plywood exports have consisted of Douglas-fir shipped to the United Kingdom.

Net plywood imports since 1949 have been as follows:

Year:	*Quantity (million square feet)*
1950	59
1951	69
1952	72
1953	211
1954	427
1955	617

With rapidly rising net imports after 1950 the ratio of hardwood plywood imports to domestic hardwood plywood consumption increased sharply. In 1952 the ratio was about 11 percent; currently it is in excess of 30 percent. Various factors including reductions in tariffs on hardwood plywood, a high level of domestic construction, the increased popularity of flush doors,[156] and the expansion of foreign production facilities combined to cause the increase.

So far, imports have been primarily supplemental to domestic production. Assuming that they continue in this role, some increases can be anticipated as demand for hardwood plywood in construction and in manufacturing grows larger. Accordingly, net imports have been set at 1 billion square feet in 1975 and 1.5 billion square feet in 2000. These estimates represent an equivalent log volume of 313 and 472 million board-feet, respectively. In view of anticipated domestic demand, no significant increase is expected in exports.

Veneer Imports Have Been Increasing

Trends in the imports of veneer have in general followed those of plywood (table 271 and fig. 132). Before 1946, veneer imports were relatively insignificant, but since 1948 they have increased from 54 million square feet to 765 million square feet in 1955. In the latter year about 88 percent of the veneer imports originated in Canada. Maple and birch veneers account for about half of the veneer received from Canada.

Exports (excepting the war years when they reached a peak of 448 million square feet in 1943) have not been important. In 1955, exports amounted to 52 million square feet—equal to about 7 percent of the volume of imports. Since 1950 most of the veneer exports (85 percent in 1955) have gone to Canada.

Net imports of veneer since 1950 have been as follows:

Year:	*Quantity (million square feet)*
1950	327
1951	403
1952	397
1953	534
1954	541
1955	714

Veneer imports, as in the case of plywood, are supplementary to domestic production, and it seems logical to assume that imports will increase as demand for hardwood plywood and veneer increases. Accordingly, net imports are estimated at 1.4 billion square feet in 1975 and 2.0 billion square feet in 2000. These estimates represent an equivalent log volume of 112 and 158 million board-feet, respectively. Exports are not expected to be significant.

[156] Most of the plywood imports from Japan consist of panels used primarily in the domestic manufacture of flush doors.

TABLE 271.—*Exports and imports of veneer, by kind, 1935–55*

[Thousand square feet]

Year	Exports			Imports		
	Total	Fancy, face, figured, and special	Utility, commercial, and container	Total	Birch or maple	Other
1935	50, 448			4, 717		
1936	52, 952			5, 236		
1937	83, 738			9, 131		
1938	50, 144			5, 726		
1939	64, 542			9, 390	2, 518	6, 872
1940	125, 571	39, 095	86, 476	15, 971	4, 320	11, 651
1941	189, 737	25, 433	164, 304	16, 284	9, 121	7, 163
1942	278, 126	119, 119	159, 007	5, 988	5, 976	12
1943	447, 812	412, 088	35, 724	2, 189	2, 080	109
1944	294, 161	263, 265	30, 896	246	246	0
1945	95, 887	60, 070	35, 817	4, 380	3, 820	560
1946	151, 306	72, 018	79, 288	27, 947	21, 986	5, 961
1947	191, 988	64, 152	127, 836	47, 503	35, 593	11, 910
1948	65, 621	18, 242	47, 370	54, 283	51, 887	2, 396
1949	33, 589	20, 242	13, 347	174, 955	73, 156	101, 799
1950	34, 518	20, 780	13, 738	361, 930	161, 852	200, 078
1951	40, 612	22, 139	18, 482	443, 232	177, 486	265, 746
1952	30, 689	19, 080	11, 609	428, 000	253, 304	174, 696
1953	49, 147	31, 900	17, 247	583, 517	335, 607	247, 910
1954	43, 292	27, 753	15, 539	584, 205	312, 215	271, 990
1955	51, 736	28, 608	23, 128	765, 373	328, 980	436, 393

Source: U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce and Bureau of the Census.

Trade in Veneer Logs and Bolts Is Small

The United States has carried on a small international trade in veneer logs since about 1910 (table 272). Imports have fluctuated between a high of 346 million board-feet in 1927 and a low of 54 million board-feet in 1934 and have averaged about 200 million board-feet annually. Softwoods, which have accounted for more than half of the veneer logs imported in nearly all years since 1910, have originated almost entirely in Canada. Hardwood veneer log imports have originated in a number of different tropical countries—the Philippine Republic, French West Africa, the Gold Coast, and Colombia are the most important. Small quantities of hardwood logs have been imported from Canada.

In contrast to imports, there has been a downward trend in exports of veneer logs. Reaching a peak of 431 million board-feet in 1928, exports declined to a low of 14 million board-feet in 1945. Since 1945 exports have again increased to 166 million board-feet in 1955, but there is no evidence to indicate that they will reach the levels attained in the late 1920's.

TABLE 272.—*Imports and exports of veneer logs and bolts,*[1] *selected years, 1910–55*

[Million board-feet]

Year	Imports				Exports		
	Total [2]	Softwoods	Hardwoods	Mixed	Total [2]	Softwoods	Hardwoods
1910	241						
1911	236						
1912	213				191		
1913	226				208		
1925	304	93	92	119	162	137	24
1926	262	70	85	107	243	231	12
1927	346	145	92	109	324	304	19
1928	224	77	66	81	431	415	16
1929	273	120	81	72	379	362	17
1930	152	100	52	(3)	306	289	17
1931	173	148	25	(3)	266	247	19
1932	100	87	13	(3)	137	119	19
1933	127	119	8	(3)	168	150	18
1934	54	37	12	5	241	224	17
1935	132	102	22	7	288	271	16
1936	102	66	33	3	327	301	25
1937	166	118	40	9	170	146	24
1938	190	151	36	3	113	89	24
1939	234	200	33	(4)	122	100	22
1940	203	167	36	(4)	71	53	18
1941	334	298	36	0	36	26	10
1942	194	168	26	0	31	20	11
1943	114	73	41	(4)	19	9	10
1944	158	103	55	(4)	22	15	8
1945	137	87	50	(4)	14	10	5
1946	155	93	61	(4)	15	6	8
1947	168	84	84	(4)	45	22	23
1948	256	154	102	(4)	55	25	30
1949	190	133	56	(4)	71	42	29
1950	268	156	112	0	48	29	19
1951	212	85	127	0	79	58	21
1952	191	114	77	0	64	44	19
1953	227	115	112	0	115	86	29
1954	221	128	93	0	139	106	33
1955	199	79	119	0	166	144	22

[1] Includes an undisclosed volume of logs used for purposes other than veneer.
[2] Data in other columns may not add to total because of rounding.
[3] Stated in dollar values only.
[4] Less than 500,000 board-feet.

Source: U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce and Bureau of the Census.

The decline in veneer log exports has been almost wholly confined to softwoods. Exports of hardwood logs and bolts have remained relatively stable since 1912. Nearly 80 percent of all log and bolt exports in 1955 were shipped to Canada. As a result of the decline in exports the United States became a net importing nation in 1938. It is expected to remain so in the future.

It is estimated that in 1975 there will be a net import of 200 million board-feet of veneer logs and bolts as compared to 127 million board-feet in 1952. By 2000 net imports are expected to rise to 300 million board-feet. The anticipated

increase in imports is expected to be confined largely to imports of tropical hardwoods. Net imports of softwood veneer logs and bolts are not expected to change appreciably.

Summary of Anticipated Net Import Position of All Timber Products in 1975 and 2000

Lumber, pulpwood and pulpwood products, and veneer logs and veneer products make up the great bulk of United States international trade in timber products. Various other products such as poles, piling, shingle bolts, hewn ties, and many other items regularly entering the international trade are inconsequential and have not been considered in arriving at the net import figures for timber products which follow.

Net imports of timber products are expected to rise from 1,176 million cubic feet in 1952 to 1,661 million cubic feet in 1975 and to 1,787 million cubic feet in 2000 (table 273). In the future, as in the past, softwoods will probably comprise the major share of lumber, pulpwood, and pulpwood product imports (table 274). For all products combined, the increase in net imports (roundwood equivalent) implied by these estimates amounts to 41 percent during the period 1952–75 and to 52 percent during the period 1952–2000.

SUMMARY OF PROJECTED DEMANDS FOR TIMBER PRODUCTS AND ESTIMATES OF THE TIMBER CUT REQUIRED TO MEET THEM

The foregoing projections of future demand imply that the market outlook for most timber products should be highly favorable. Large increases in demand are indicated for pulpwood and for veneer logs and bolts. Even in the case of saw logs and minor products, the rise in demand may be considerable. Fuelwood is the only major product for which a rather drastic decrease in demand is expected (table 275). The market prospect offers a challenging opportunity for both forest land managers and the forest industries.

The *medium projections* of demand for each product are the basic estimates. These rest on the assumptions that the Nation will enjoy continued peace and prosperity, that population will increase to 215 million by 1975 and 275 million by 2000, that the price of industrial wood will generally parallel the price of competing materials, and that industrial wood will maintain its present relative position in the national economy.

Expressed in terms of roundwood (logs and bolts), the various medium projections of demand for timber products add up to totals of 16.2 billion cubic feet by 1975, and 22.4 billion cubic feet by 2000 (table 276). Compared with the 12.3 billion cubic feet of timber products consumed in 1952, these totals are 32 and 83 percent higher, respectively. But on a per capita basis, the projected changes in demand are relatively small—75 cubic feet in 1975 and 82 cubic feet in 2000, as against 78 cubic feet consumed in 1952. Considering industrial wood only, however, the projected per capita demand amounts to 72 cubic feet by 1975 and 80 cubic feet by 2000 or 7 and 15 cubic feet respectively above 1952 consumption.

The *upper projection* of demand for timber products rests on the same basic assumptions as the medium projection except that population is assumed to reach 360 million by 2000. Projected demand by 2000, under these assumptions, may be approximately 26.2 billion cubic feet—17 percent above the medium projection and 114 percent above 1952 consumption. But large as it appears to be, this estimate allows for a per capita demand of only 73 cubic feet against the 78 cubic feet consumed in 1952. Per capita demand for industrial wood at the upper projection for 2000 is about 71 cubic feet as compared with 65 cubic feet in 1952.

The *lower projected demand* is based on the same population and gross national product assumptions as the emdium projection. But future prices of timber products are assumed to rise substantially faster than prices of competing materials. Under these assumptions, lower projected demand for timber products may be in the vicinity of 14.2 billion cubic feet by 1975 and 17.9 billion cubic feet by 2000. Comparable estimates for industrial wood are 13.4 billion cubic feet by 1975 and 17.4 billion by 2000—13 and 21 percent less, respectively, than medium projected demand, but 30 and 70 percent more, respectively, than industrial wood consumption in 1952. These lower projections of demand for industrial wood imply a drop in per capita consumption from 65 cubic feet in 1952 to 62 and 63 cubic feet, respectively, by 1975 and 2000. Thus they imply a declining role for wood in the national economy.

If all three projections of demand are compared in terms of change from 1952, the results are as follows:

	Percent change		
	Industrial wood	*Fuelwood*	*All products*
Medium projection:			
1975	+50	−59	+32
2000	+114	−74	+83
Upper projection:			
2000	+150	−74	+114
Lower projection:			
1975	+30	−59	+16
2000	+70	−74	+46

In terms of per capita demand for industrial wood, the same comparison shows increases over 1952 consumption of about 10 percent for the medium projection by 1975 and 22 percent by 2000. The

TABLE 273.—*United States net imports of timber products, 1952, and anticipated net imports in 1975 and 2000*

Product	Standard unit of measure	1952		1955		1975		2000	
		In std. units [1]	Round-wood [2]	In std. units	Round-wood [2]	In std. units	Round-wood [2]	In std. units	Round-wood [2]
		Million	*Million cu. ft.*	*Million*	*Million cu. ft.*	*Million*	*Million cu. ft.*	*Million*	*Million cu. ft.*
Lumber	Bd.-ft., lumber tally.	1, 752	273	2, 755	429	3, 000	470	3, 000	470
Pulpwood and pulpwood products:									
Pulpwood	Standard cords	2. 3	179	1. 9	157	1. 0	78	1. 0	78
Woodpulp	Tons	1. 7	242	1. 6	235	1. 8	312	2. 3	312
Newsprint and other paper.	do	4. 6	453	4. 5	446	7. 1	702	7. 9	780
Total			874		838		1, 092		1, 170
Veneer logs and veneer products:									
Logs and bolts [3]	Bd.-ft., log scale	127	20	33	5	200	31	300	47
Veneer	Sq. ft., surface measure.	397	5	714	9	1, 400	18	2, 000	25
Plywood	do	72	4	617	30	1, 000	50	1, 500	75
Total			29		44		99		147
Total, all products			1, 176		1, 311		1, 661		1, 787

[1] U. S. Department of Commerce, Bureau of the Census. *United States Imports of Merchandise*, Rpt. F. T. 110; and *United States Exports of Domestic and Foreign Merchandise*, Rpt. F. T. 410. Washington, D. C. 1953 and 1955.

[2] Roundwood volume equivalent, excluding bark.

[3] Includes an undisclosed volume of logs used for products other than veneer.

TABLE 274.—*United States net imports of timber products, 1952 and 1955, and anticipated net imports, 1975 and 2000, by product and species group* [1]

Year and species group	Lumber		Pulpwood and pulpwood products		Veneer logs and veneer products		All products
	Million bd.-ft.	*Million cu. ft.*	*Million std. cords*	*Million cu. ft.*	*Million bd.-ft.*	*Million cu. ft.*	*Million cu. ft.*
1952:							
Softwood	1, 701	265	10. 7	834	80	13	1, 112
Hardwood	51	8	. 5	40	100	16	64
Total	1, 752	273	11. 2	874	180	29	1, 176
1955:							
Softwood	2, 675	417	10. 1	803	128	20	1, 240
Hardwood	80	12	. 4	35	155	24	71
Total	2, 755	429	10. 5	838	283	44	1, 311
1975:							
Softwood	2, 900	455	13. 0	1, 014	130	20	1, 489
Hardwood	100	15	1. 0	78	500	79	172
Total	3, 000	470	14. 0	1, 092	630	99	1, 661
2000:							
Softwood	2, 900	455	14. 0	1, 092	200	32	1, 579
Hardwood	100	15	1. 0	78	730	115	208
Total	3, 000	470	15. 0	1, 170	930	147	1, 787

[1] Volumes are in terms of roundwood.

TABLE 275.—*Estimated domestic consumption of timber products, 1952, and projections of demand, 1975 and 2000* [1]

Product	Standard unit of measure	Domestic consumption, 1952	Projections of demand: 1975 Lower	1975 Medium	2000 Lower	2000 Medium	2000 Upper
		Million units	*Million units*	*Million units*	*Million units*	*Million units*	*Million units*
Saw logs for lumber [2]	Bd.-ft., lumber tally	41, 462	47, 600	55, 500	54, 800	79, 000	90, 000
Pulpwood [3]	Standard cords	35. 4	65	72	90	100	125
Veneer logs and bolts [4]	Bd.-ft., log scale	2, 647	5, 000	5, 670	7, 500	9, 000	10, 500
Cooperage logs and bolts	do	355. 3	510	600			
Piling	Linear feet	41. 2	45	59	*Million*	*Million*	*Million*
Poles	Pieces	6. 5	4. 9	6. 5	*cu. ft.*	*cu. ft.*	*cu. ft.*
Posts (round and split)	do	306	337	400	1, 160	1, 450	1, 740
Hewn ties	do	10. 2	0	0			
Mine timbers (round)	Cubic feet	81	87	105			
Other industrial wood	do	227	314	350			
					Million units	*Million units*	*Million units*
Fuelwood [5]	Standard cords	58. 6	34	34	25	25	25

[1] Includes net imports and volume of products recovered from plant residues.

[2] Lumber, timbers, sawed ties, etc.; includes saw-log equivalent of net imports of lumber.

[3] Includes pulpwood net imports and pulpwood equivalent of woodpulp and paper.

[4] Includes net imports of veneer logs and bolts or veneer-log equivalent of veneer and veneer products.

[5] For industrial as well as home use. Includes plant residues used for fuel.

TABLE 276.—*Estimated domestic consumption of roundwood for timber products, 1952, and projections of demand, 1975 and 2000* [1]

Product	Domestic consumption, 1952	Projections of demand: 1975 Lower	1975 Medium	2000 Lower	2000 Medium	2000 Upper
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Saw logs for lumber [2]	6, 419	7, 140	8, 383	8, 549	12, 090	13, 578
Pulpwood	2, 697	4, 698	5, 264	6, 514	7, 125	8, 925
Veneer logs and bolts	451	860	946	1, 301	1, 478	1, 724
Cooperage logs and bolts	73	97	109			
Piling	28	30	37			
Poles	88	67	88			
Posts (round and split)	194 } 699	175 } 675	224 } 795	1, 043	1, 227	1, 473
Hewn ties	67	-----	-----			
Mine timbers (round)	81	87	105			
Other industrial wood	168	219	232			
Total, all industrial wood	10, 266	13, 373	15, 388	17, 407	21, 920	25, 700
Fuelwood	2, 008	818	818	519	519	519
Total, all timber products	12, 274	14, 191	16, 206	17, 926	22, 439	26, 219

[1] Includes roundwood equivalent of net imports of lumber, pulpwood, woodpulp and paper, veneer logs and bolts and veneer-log equivalent of veneer and veneer products. Includes roundwood volume cut from dead and cull trees. Volume of products recovered from plant residues is included in the roundwood volume from which the residue was obtained. Veneer cores, for example, are plant residues often used for pulpwood; here they are included in the volume of veneer logs and bolts.

[2] Lumber, timbers, sawed ties, etc.

increase for the upper projection by 2000 is 9 percent. Under the lower projection, per capita demand decreases from 1952 consumption—5 percent by 1975 and about 3 percent by 2000. Decreases in per capita demand for fuelwood amount to 70 percent by 1975 and 85 to 90 percent by 2000.

	Per capita demand, in cubic feet		
	Industrial wood	*Fuelwood*	*All products*
Consumption in 1952	65.4	12.8	78.2
Medium projection:			
1975	71.6	3.8	75.3
2000	79.7	1.9	81.6
Upper projection:			
2000	71.4	1.4	72.8
Lower projection:			
1975	62.2	3.8	66.0
2000	63.3	1.9	65.2

Future Demands Expected To Be Partly Met Through Increased Imports

The foregoing summaries of projected demand for timber products include timber products that will be obtained from sources outside the United States and Alaska. For hundreds of years this country has traded timber products for the goods of other countries; some timber products were imported, but exports exceeded imports. But in more recent times, the United States has become the world's largest importing nation as far as timber products are concerned. In 1952 imports of timber products exceeded exports by the equivalent of 1.2 billion cubic feet of roundwood. Thus, about 10 percent of that year's total consumption was accounted for by *net* imports.

This international trade position is expected to continue. By 1975, net imports may increase to 1.7 billion cubic feet; by 2000 they may be as much as 1.8 billion cubic feet. If net imports rise to these levels they may include:

Product:	*1952*	*1975*	*2000*
Lumber ... billion bd.-ft.	1.8	3	3
Pulpwood and pulpwood products million cords	11.2	14	15
Veneer logs and veneer products million bd.-ft.	180	630	930

When the estimates of projected demand (table 275) are reduced by the volume of net imports and adjusted for changes in stocks, the remaining volumes are estimates of the *domestic output* of logs and bolts required to meet projected demands for timber products (table 277).

Timber Cut Required To Meet Future Projected Demands for Domestic Timber Products

Starting with the estimates of domestic output, the final step in the analysis is to calculate the annual cuts of growing stock and live sawtimber needed to meet projected demands for timber products in 1975 and 2000. This calculation requires consideration of (a) the volume of product obtained from plant residues; (b) the extent to which dead and cull trees, trees on noncommercial forest land, and trees on nonforest land are utilized; and (c) the degree to which timber cut is actually utilized for products. All of these factors are related to economic conditions and technological progress in the forest industries.

The forest industries have made substantial progress in using more of the less desirable timber and in making more complete use of the trees that are cut. Further progress, resulting in increased timber-products output with commensurate decreases in timber cut per unit of product output, is expected. There are, of course, some obstacles: for example, declining average tree size in the West points toward an increasing volume of timber cut per board-foot of lumber produced. Nevertheless, estimates from every region anticipate a net improvement in utilization during the years ahead. That improvement—and the "savings" that would result from it—are reflected in the calculations of the timber cut required to meet projected demand for timber products.

Converting Factors Are Used

The transition from demand for timber products to timber cut may be illustrated by the 1952 data for softwood pulpwood output and timber cut. In that year 31.3 million cords of softwood pulpwood were consumed in the United States and Coastal Alaska, including the equivalent of 10.7 million cords of net imports from abroad, in the forms of paper, paperboard, woodpulp, and pulpwood. The consumption of pulpwood cut from forests of the United States thus amounted to 20.6 million cords. During that year, softwood pulpwood stocks on hand increased 0.8 million cords. Adding this to consumption indicates that the total output of softwood pulpwood from the forests of the United States was 21.4 million cords.

The utilization factors for softwood pulpwood in 1952 are the quantities of growing stock or live

TABLE 277.—*Domestic output of timber products, 1952, and estimates of output required to meet projected demand, 1975 and 2000* [1]

Product and species group	Standard unit of measure	Domestic output 1952	Domestic output required to meet projected demand				
			1975		2000		
			Lower	Medium	Lower	Medium	Upper
		Million units	*Million units*	*Million units*	*Million units*	*Million units*	*Million units*
Saw logs for lumber:							
Softwood	Bd.-ft. lumber tally	31, 507	33, 900	39, 500	38, 200	56, 000	64, 100
Hardwood	do	8, 003	10, 700	13, 000	13, 600	20, 000	22, 900
Total	do	39, 510	44, 600	52, 500	51, 800	76, 000	87, 000
Pulpwood:							
Softwood	Standard cords	21. 4	35	40	53	60	75
Hardwood	do	3. 7	16	18	22	25	35
Total	do	25. 1	51	58	75	85	110
Veneer logs and bolts:							
Softwood	Bd.-ft., log scale	1, 548	3, 270	3, 790	4, 720	5, 800	6, 800
Hardwood	do	919	1, 100	1, 250	1, 850	2, 270	2, 770
Total	do	2, 467	4, 370	5, 040	6, 570	8, 070	9, 570
Cooperage logs and bolts:							
Softwood	Bd.-ft., log scale	117. 9	152	200			
Hardwood	do	237. 4	358	400			
Total	do	355. 3	510	600			
Piling:							
Softwood	Linear feet	37. 9	40	53			
Hardwood	do	3. 3	5	6			
Total	do	41. 2	45	59			
Poles:							
Softwood	Pieces	6. 4	4. 8	6. 4			
Hardwood	do	. 1	. 1	. 1			
Total	do	6. 5	4. 9	6. 5	*Million cubic feet*	*Million cubic feet*	*Million cubic feet*
Posts (round and split):							
Softwood	Pieces	103. 3	105	140	580	725	870
Hardwood	do	202. 7	232	260	580	725	870
Total	do	306. 0	337	400	1, 160	1, 450	1, 740
Hewn ties:							
Softwood	Pieces	3. 7	0	0			
Hardwood	do	6. 5	0	0			
Total	do	10. 2	0	0			
Mine timbers (round):							
Softwood	Cubic feet	18. 5	20	26			
Hardwood	do	62. 5	67	79			
Total	do	81. 0	87	105			
Other industrial wood:							
Softwood	Cubic feet	112. 3	157	175			
Hardwood	do	114. 7	157	175			
Total	do	227. 0	314	350	*Million units*	*Million units*	*Million units*
Fuelwood:							
Softwood	Standard cords	31. 1	18	18	15	15	15
Hardwood	do	27. 5	16	16	10	10	10
Total	do	58. 6	34	34	25	25	25

[1] Figures for individual products include plant residues utilized for that purpose.

sawtimber cut per cord of pulpwood output. In terms of growing stock the calculation is as follows:

		Volume (million cu. ft.)
Total United States output (21.4 million cords)		1, 659
Less: Plant residues used for pulpwood		109
Output of pulpwood logs and bolts		1, 550
Less: Output from—		
Dead trees	26	
Cull trees [1]	107	
Trees on noncommercial and on nonforest land	10	
All non-growing-stock sources		143
Output from growing stock		1, 407
Plus: Logging residues from pulpwood cutting		53
Timber cut for pulpwood from growing stock		1, 460

[1] Also includes tops and limbs and trees of commercial species under 5.0 inches in diameter.

This illustration shows that the 1952 output of 21.4 million cords of softwood pulpwood required a cut of 1,460 million cubic feet of growing stock, or 68 cubic feet per cord. In terms of board-foot volume from sawtimber trees, the cut amounted to 4,252 million board-feet or 198 board-feet per cord of softwood pulpwood output. Similar utilization factors have been derived for hardwood pulpwood, and for the cut of softwood and hardwood associated with output of the various other timber products.[157]

Fuller Utilization Anticipated

Anticipated changes in relationship of product output to timber cut, between 1952 and 1975, are estimated for each product in each region, by softwoods and hardwoods, and the 1952 utilization factors are modified accordingly. Utilization factors for 2000 are derived by projecting the 1952–75 trends, modifying them as the outlook for utilization conditions in individual regions or for particular products may suggest. Although based initially on past experience, future utilization factors are, of course, a matter of judgment.

To continue the softwood pulpwood illustration, comparison of the annual cut of growing stock and of live sawtimber—per cord of domestic pulpwood output required by the medium projected demand for pulpwood in 1975 and 2000—indicates how the utilization factors were projected:

Year:	Growing stock (cu. ft. per cord)	Live sawtimber (bd.-ft. per cord)
1952	68	198
1975	57	151
2000	53	149

[157] See appendix section on converting factors.

Fuller Utilization Means Savings of Timber

Comparing the cut required to meet future projected demand under anticipated changes in utilization practices with the cut required to meet the same demand under 1952 utilization practices, it is apparent that sizable "savings" are implied. Thus, future sawtimber savings due to fuller utilization of timber cut to meet the medium projected demands for softwood pulpwood are expected to be about 23.7 percent by 1975 and 24.4 percent by 2000:

	1975	2000
Medium projected demand for softwood pulpwood (million cords)	40	60
Cut of live sawtimber per cord:		
1952 factor (bd.-ft.)	198	198
Anticipated factor (bd.-ft.)	151	149
Cut of live sawtimber based on:		
1952 factor (million bd.-ft.)	7, 920	11, 880
Anticipated factor (million bd.-ft.)	6, 040	8, 980
Savings (million bd.-ft.)	1, 880	2, 900

For the country as a whole, and for all species, the savings anticipated from fuller utilization of the cuts of live sawtimber required to meet medium projected demands for various products in 1975 and 2000 work out to 4.8 and 5.1 percent.

	1952–75 (percent)	1952–2000 (percent)
Saw logs	1. 7	1. 8
Pulpwood	18. 6	20. 0
Veneer logs and bolts	1. 9	2. 0
Fuelwood	10. 3	23. 7
Other products	9. 7	9. 7
All products	4. 8	5. 1

Applying these percentage savings for live sawtimber, and similarly estimated savings for growing stock, the total savings in the timber cuts required to meet the three projected demands for all products in 1975 and 2000 are as follows:

	Live sawtimber (billion bd.-ft.)	Growing stock (billion cu. ft.)
Lower projected demand:		
1975	2. 8	1. 0
2000	4. 3	1. 3
Medium projected demand:		
1975	3. 3	1. 5
2000	5. 1	2. 7
Upper projected demand:		
2000	6. 2	3. 3

Timber Cut Estimates Derived From Estimates of Timber Products Output in 1975 and 2000

Beginning with the domestic output of each timber product, deducting that part of the output obtained from plant residues and from non-growing-stock sources, adding the volume of

logging residues, and allowing for anticipated savings in future utilization practice, the calculations of timber cut for each product in 1975 and 2000 are similar to the calculations just described for softwood pulpwood.

For all products combined, the medium projection of timber cut from growing stock implies a rise from 10.8 billion cubic feet in 1952 to 14 billion cubic feet in 1975 and 19.7 billion cubic feet in 2000 (table 278). The corresponding medium projections of timber cut from live sawtimber are 65.4 billion board-feet and 95.1 billion board-feet, compared with 48.8 billion board-feet in 1952 (table 279). The lower and upper projections of timber cut bear about the same relationship to the medium projection as they do in the series of timber product demand projections previously set forth.

All of the timber-cut estimates provide for increasing use of hardwoods. In 1952, about 30 percent of the growing stock cut was hardwood, but the two 1975 hardwood estimates are both 32 percent of the total and the three 2000 hardwood estimates are about 34 percent. The hardwood component of the live sawtimber cut rises from 25 percent in 1952 to 27 percent in 1975 and 28 percent in 2000.

Comparing the various estimates of timber cut with the volume of timber cut in 1952—10.8 billion cubic feet of growing stock, including 48.8 billion

TABLE 278.—*Timber cut from growing stock, 1952, and projections of timber cut, 1975 and 2000*

Product and species group	Timber cut 1952	Projections of timber cut from growing stock				
		1975		2000		
		Lower	Medium	Lower	Medium	Upper
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Saw logs for lumber:						
Softwood	5, 214	5, 438	6, 203	6, 030	8, 279	9, 486
Hardwood	1, 607	1, 924	2, 216	2, 555	3, 624	4, 145
Total	6, 821	7, 362	8, 419	8, 585	11, 903	13, 631
Pulpwood:						
Softwood	1, 460	2, 038	2, 284	2, 997	3, 195	3, 975
Hardwood	267	1, 050	1, 115	1, 484	1, 638	2, 275
Total	1, 727	3, 088	3, 399	4, 481	4, 833	6, 250
Veneer logs and bolts:						
Softwood	251	537	611	760	878	1, 027
Hardwood	241	289	310	511	605	736
Total	492	826	921	1, 271	1, 483	1, 763
Minor wood products:						
Softwood	319	286	355	426	538	645
Hardwood	394	366	401	568	630	755
Total	713	652	756	994	1, 168	1, 400
Total all industrial wood:						
Softwood	7, 244	8, 299	9, 453	10, 213	12, 890	15, 133
Hardwood	2, 509	3, 629	4, 042	5, 118	6, 497	7, 911
Total	9, 753	11, 928	13, 495	15, 331	19, 387	23, 044
Fuelwood:						
Softwood	243	104	104	95	95	95
Hardwood	761	395	395	231	231	231
Total	1, 004	499	499	326	326	326
Total all timber products:						
Softwood	7, 487	8, 403	9, 557	10, 308	12, 985	15, 228
Hardwood	3, 270	4, 024	4, 437	5, 349	6, 728	8, 142
Total	10, 757	12, 427	13, 994	15, 657	19, 713	23, 370

TABLE 279.—*Timber cut from live sawtimber, 1952, and projections of timber cut, 1975 and 2000*

Product and species group	Timber cut 1952	Projections of timber cut from live sawtimber				
		1975		2000		
		Lower	Medium	Lower	Medium	Upper
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Saw logs for lumber:						
Softwood	28, 890	30, 827	35, 950	34, 786	50, 990	58, 330
Hardwood	7, 746	9, 878	12, 000	12, 524	18, 470	21, 137
Total	36, 636	40, 705	47, 950	47, 310	69, 460	79, 467
Pulpwood:						
Softwood	4, 252	5, 285	6, 040	7, 897	8, 980	11, 175
Hardwood	441	1, 936	2, 178	2, 596	2, 955	4, 130
Total	4, 693	7, 221	8, 218	10, 493	11, 935	15, 305
Veneer logs and bolts:						
Softwood	1, 575	3, 300	3, 829	4, 767	5, 858	6, 868
Hardwood	1, 228	1, 399	1, 590	2, 359	2, 896	3, 532
Total	2, 803	4, 699	5, 419	7, 126	8, 754	10, 400
Minor wood products:						
Softwood	1, 234	1, 105	1, 458	1, 885	2, 357	2, 827
Hardwood	1, 228	1, 092	1, 217	1, 519	1, 899	2, 279
Total	2, 462	2, 197	2, 675	3, 404	4, 256	5, 106
Total all industrial wood:						
Softwood	35, 951	40, 517	47, 277	49, 335	68, 185	79, 200
Hardwood	10, 643	14, 305	16, 985	18, 998	26, 220	31, 078
Total	46, 594	54, 822	64, 262	68, 333	94, 405	110, 278
Fuelwood:						
Softwood	595	343	343	225	225	225
Hardwood	1, 651	825	825	450	450	450
Total	2, 246	1, 168	1, 168	675	675	675
Total all timber products:						
Softwood	36, 546	40, 860	47, 620	49, 560	68, 410	79, 425
Hardwood	12, 294	15, 130	17, 810	19, 448	26, 670	31, 528
Total	48, 840	55, 990	65, 430	69, 008	95, 080	110, 953

board-feet of live sawtimber—percentage increases are as follows:

	Percent increase	
	1952–75	*1952–2000*
Growing stock cut:		
Lower projection	16	46
Medium projection	30	83
Upper projection	--	117
Live sawtimber cut:		
Lower projection	15	41
Medium projection	34	95
Upper projection	--	127

All Projections Point to Higher Demand for Timber Products and Associated Timber Cut

This section has described the nature and likely magnitude of future demand for timber under several explicit assumptions. The analyses have shown how demand for timber products might rise under these assumptions. Part of future demand

probably can be met by increasing imports, but the major share must come from increased domestic output. If domestic output keeps pace with rising demand for timber products, as projected here, the cut of timber associated with rising output must increase accordingly (table 280).

These projections are not intended to be forecasts of future consumption. Rather, their purpose is to provide a framework for the analysis of future timber-supply possibilities in the section to follow. Yet the obvious conclusion is that demands for timber products, and hence the timber cuts associated with those demands, will be considerably higher in the future than they have ever been in the past. Other reasonable assumptions might be chosen and somewhat different estimates might be calculated, but no other general conclusion appears reasonable.

TABLE 280.—*Estimated domestic consumption, domestic output of timber products, and timber cut in the United States and Coastal Alaska, by softwoods and hardwoods, 1952; and projections of demand, output, and timber cut, 1975 and 2000*

Item	Total demand (roundwood)	Less net imports	Domestic output	Timber cut [1]		
				Growing stock	Live sawtimber	
	Billion cu. ft.	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion bd-ft.*
Consumption, 1952:						
Softwood	8. 6	1. 1	7. 5	7. 5	6. 6	36. 5
Hardwood	3. 7	. 1	3. 6	3. 3	2. 5	12. 3
Total	12. 3	1. 2	11. 1	10. 8	9. 1	48. 8
Lower projections:						
1975:						
Softwood	9. 9	1. 5	8. 4	8. 4	7. 3	40. 9
Hardwood	4. 3	. 2	4. 1	4. 0	3. 0	15. 1
Total	14. 2	1. 7	12. 5	12. 4	10. 3	56. 0
2000:						
Softwood	12. 5	1. 6	10. 9	10. 3	8. 9	49. 6
Hardwood	5. 4	. 2	5. 2	5. 4	3. 9	19. 4
Total	17. 9	1. 8	16. 1	15. 7	12. 8	69. 0
Medium projections:						
1975:						
Softwood	11. 4	1. 5	9. 9	9. 6	8. 3	47. 6
Hardwood	4. 8	. 2	4. 6	4. 4	3. 3	17. 8
Total	16. 2	1. 7	14. 5	14. 0	11. 6	65. 4
2000:						
Softwood	15. 6	1. 6	14. 0	13. 0	11. 3	68. 4
Hardwood	6. 8	. 2	6. 6	6. 7	4. 9	26. 7
Total	22. 4	1. 8	20. 6	19. 7	16. 2	95. 1
Upper projection, 2000:						
Softwood	17. 9	1. 6	16. 3	15. 3	13. 1	79. 5
Hardwood	8. 3	. 2	8. 1	8. 1	5. 8	31. 5
Total	26. 2	1. 8	24. 4	23. 4	18. 9	111. 0

[1] Derived from domestic output. Thus for 1952 represents domestic output (11.1 billion cu. ft.) less output from dead trees, cull trees, noncommercial forest land and nonforest land (1.7 billion cu. ft.) plus logging residues (1.4 billion cu. ft.). In 1975 and 2000 reflects due allowance for improvements in utilization and quantity of products from dead and cull trees and other non-growing-stock sources.

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Timber Supply Outlook

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TIMBER SUPPLY OUTLOOK

Leonard I. Barrett
S. Blair Hutchison

INTRODUCTION

Major objectives of forest policy in the United States are to currently grow sufficient timber to meet national requirements and to build up timber resources so that expected rising demands can be sustained. Only by reaching these objectives can the timber capital or inventory remain in condition to supply requirements permanently.

Preceding sections of this report have presented the current situation with respect to inventory, growth and utilization of timber supplies, protection, planting, productivity of recently cut lands, ownership, and the relation of domestic to foreign resources. Projected timber demands or requirements for the years 1975 and 2000 have also been estimated. This section presents projections of timber supply and, for the first time in this report, compares projections of both supply and potential demand. The comparisons constitute, in broad perspective, the outlook for the timber situation during the rest of this century.

The outlook period, extending to 2000, is longer than periods commonly used in projecting needs and supplies of most resources. The reason is that standing timber is a long-term crop and supplies cannot be readily adjusted annually. Many of the most fundamental actions affecting supplies have no practical effect for several decades. For example, the improvements in some aspects of inventory and growth since 1945, shown in the sections Forest Land and Timber and Growth and Utilization, are more the result of forestry efforts made 30 to 40 years ago than of those made after 1945. Thus, the outlook period used in projecting timber supplies must be long enough to include the effects of actions requiring several decades for concrete results.

Two broad methods for long-range projections of net growth and inventory were considered during planning stages. One method involved calculation for selected future years of the positive or negative effects on net growth and inventory that could be expected from each type of action or effort affecting supplies, and the subtraction from, or addition to, the 1952 base of each effect. Thus, the separate effects of expected trends in protection, planting, improved silvicultural practices, timber cut, and other factors would be determined individually by a "bookkeeping" procedure.

The "bookkeeping" procedure was cumbersome, and limitations in knowledge prohibited its use for some important species groups in some regions. Since it could not be adopted as a standard method, formulae were finally chosen as the more suitable approach. Formulae were used to measure the changing growth and inventory for future periods by projecting values for the factors affecting change. These factors were timber removal, gross growth (net growth plus mortality), and mortality and ingrowth (the net volume of trees that reach minimum measured size in a given period).

Gross growth, mortality, ingrowth, and timber removal are factors of known quantity for 1952, but they will be changed in subsequent years by continuing forestry efforts. In application, these factors were adjusted to account for changes in the intensity of forestry expected from continuation of recent trends. Projected net growth and inventory thus include the effects of these trends.

The "formula" approach has the following advantages: (1) Current gross growth, mortality, and ingrowth were known from results of initial coverage by the Forest Survey and from other sources; (2) changes in these factors were known for areas where the Forest Survey had completed the initial survey and one resurvey; and (3) the effects of some forestry measures on these factors were available from repeated measurements on permanent sample plots in some parts of the country. Therefore, the best information available was adaptable for direct use in formulae or provided a suitable basis from which estimated values could be made. A more detailed explanation of procedures is given in the appendix under Adequacy of Data.

Even when the best basic data available are used, statistics resulting from projections are not

likely to be as reliable as those that appraise the current situation. This is because there are gaps in the knowledge of how timber growth is affected by a given degree of forestry effort, and professional judgment and estimation must be relied upon in projecting net growth. Timber cut, too, introduces uncertainties since it has been projected on the basis of assumed trends in population, gross national product, degree of utilization, etc. These uncertainties become much greater when applied to individual species or to States or regions than when applied to national totals.

Because the projections are suitable for general rather than detailed interpretation, the data from them are presented in broad classifications. For example, species and locality are combined in the following: eastern hardwoods, eastern softwoods, western species. Projections of inventory, net growth, and timber cut are presented for those three groups rather than for softwoods and hardwoods by State and region.

The elimination of detailed classifications still leaves problems of unusual complexity. For example, projection requires consideration of two future benchmarks in time—1975 and 2000. Two levels of demand are compared—medium and lower. The four important comparisons introduced by the time element and by demand are multiplied many times by consideration of (a) the three species–geographic groups; (b) two broad size-class groups, growing stock and sawtimber, each with a different unit of measure; and (c) net growth and inventory in terms of amounts needed to support demand and also in terms of amounts available if demands continue to be met. Thus, presentation of the timber outlook even in broad perspective involves a complicated pattern of estimates and comparisons.

The following estimates are presented here:

1. The capacity of the 489 million acres of commercial forest land in this country to grow timber.

2. The volume of timber which would be removed from inventory each year to meet medium and lower levels of projected demand plus an allowance for removals due to catastrophes, and conversion of commercial forest land to other uses and unanticipated new uses for wood, none of which have been accounted for elsewhere. This is called "timber removal."

3. The growth necessary to sustain timber removals in 1975 and 2000 is also estimated; it is referred to as "needed growth."

4. The volume of live standing timber necessary to produce the "needed growth" is also presented and is called "needed inventory."

5. The net growth expected in 1975 and 2000 if (a) the timber removals of each year increase steadily to meet the rising demand and (b) forestry efforts continue to increase as indicated by recent trends. This is called "projected growth."

6. The inventory expected in 1975 and 2000 if (a) the timber removals of each year increase steadily to meet the rising demand and (b) forestry efforts continue to increase as indicated by recent trends. This is called "projected inventory."

7. The timber removal that could be sustained if an approximate balance between removal and growth was reached and maintained. This is referred to as "sustained removal."

These estimates are used for comparisons between the supplies of timber needed to meet future requirements and the supplies likely to be available if demands are met every year and if forestry progresses as indicated by recent developments. The supplies needed in the future and those expected to be available are also compared with 1952 supplies to provide additional perspective on trends. These estimates and comparisons give a basis for judgment as to the relative ease or difficulty of supplying demands in the years ahead.

Projections of supply for the upper demand level are omitted. Later discussion in this section shows that if only the medium projected demands were actually supplied each year to 1975, inventory and growth would decline so far that demands at this level could no longer be met late in the century. The intensity of forestry needed to prevent this downward supply trend and to build up the growth and inventory needed to sustain medium projected demands is far beyond the intensity expected from continuation of recent forestry trends. Consequently, projections of growth and inventory in relation to upper demands would add little from a practical standpoint to the outlook presented by projections at the medium and lower levels.

GROWTH CAPACITY MUCH HIGHER THAN CURRENT GROWTH

Benchmarks of the growth that our commercial forest lands could produce are useful in appraising the possibility of supplying needed growth.

Growth capacity for the United States and Coastal Alaska may be viewed as a series of levels, like the rungs of a ladder, the uppermost of which can be perceived only dimly. For example, if the average growth of the most productive timber stands known today for each forest type and site were extended to all commercial forest land in each type and site class, with appropriate consideration given to distribution of age classes, an annual growth of 50 billion cubic feet, including 200 billion board-feet of sawtimber, might be attained. This concept of growth capacity is highly theoretical, and it results in an estimated volume of growth that is probably not attainable under present limitations in forestry knowledge. On the other hand, new scientific developments may at some future

time expand the above concept of growth capacity. For example, growth can no doubt be greatly increased by forest genetics and by application of growth-increasing substances which are still in experimental stages. Thus, ultimate capacity cannot yet be clearly foreseen.

A more realistic rung on the ladder of growth capacity results from the concept of "realizable growth." This is the total national growth that could be attained if the present area of commercial forest land in each region were placed under the better forest management in effect today in each region. Being a more practical concept of capacity, realizable growth is useful in judging the possibility of supplying mounting future demands for timber and in determining sources of needed growth by species groups.

Realizable growth of sawtimber is 100.7 billion board-feet (table 281). This is about twice the net growth of 47.4 billion board-feet for 1952. Realizable growth of growing stock is also about double the net growth of 1952. Thus, realizable growth occupies a position on the ladder of growth capacity well above current growth but considerably below the estimates resulting from the concepts first discussed.

Eastern softwoods account for 40 percent of the realizable growth of sawtimber with eastern hardwoods and western species each producing about 30 percent. About 70 percent of realizable growth of sawtimber consists of softwood species. In terms of growing stock, eastern hardwoods account for 37 percent of realizable growth, eastern softwoods 35 percent, and western species 28 percent.

TABLE 281.—*Realizable growth and 1952 growth of sawtimber and growing stock, by species groups, United States and Coastal Alaska*

Species group	Realizable growth		1952 growth	
	Saw-timber	Grow-ing stock	Saw-timber	Grow-ing stock
	Billion bd.-ft.	*Billion cu. ft.*	*Billion bd.-ft.*	*Billion cu. ft.*
Eastern hardwoods	30.5	10.2	19.1	7.0
Eastern softwoods	39.6	9.7	17.0	4.4
Western species [1]	30.6	7.6	11.3	2.8
All species	100.7	27.5	47.4	14.2

[1] Realizable growth includes 0.5 billion board-feet of hardwood sawtimber and 0.3 billion cubic feet of hardwood growing stock; 1952 growth includes 0.3 billion board-feet of hardwood sawtimber and 0.1 billion cubic feet of hardwood growing stock.

TIMBER GROWTH AND INVENTORY NEEDED TO SUSTAIN PROJECTED DEMANDS

The volumes of live sawtimber and growing stock that must be cut to supply the various levels of demand in 1975 and 2000 were presented in the section Future Demand for Timber. The next step in exploring timber outlook is to estimate the growth and inventory needed to sustain lower and medium projected demands on a permanent basis. Before introducing these estimates, however, the concepts of "timber removal" and "needed growth" and their relationship will be discussed as an aid in the interpretation of later comparisons.

Timber removal includes the timber cut from the live inventory to supply estimated demands and a margin to allow for natural catastrophes and other contingencies. Needed growth and inventory are those quantities needed to permanently sustain timber removal. On a national basis, timber removal and needed growth are synonymous. But when species groups are considered separately, timber removal and needed growth are different quantities because ability to support removal throughout the projection period differs from growing capacity. For example, western species with 70 percent of the national sawtimber inventory and 30 percent of realizable growth capacity are capable of supplying, for the next half century, a higher proportion of the total timber removal than of needed growth.

National total timber removal of hardwoods and softwoods is apportioned separately to eastern hardwoods, eastern softwoods, and western species in accordance with the ability of each species group to support removal during the next half century with least impairment of prospects for future growth. Needed growth is determined by an apportionment of the same national timber-removal estimates in accordance with realizable growth of the species groups.

TIMBER CUT ACCOUNTS FOR MOST OF TIMBER REMOVAL

The timber cut needed to supply estimated demands accounts for most of the timber that would be withdrawn from inventory. However, there are additional withdrawals not considered in other calculations in this report that must be recognized. For example, since 1900 the average annual loss from natural catastrophes has been 2.3 billion board-feet, 13 percent of which was salvaged. Although some progress may be made in salvaging future catastrophic losses, the difficulty of recovering substantial amounts before spoilage means that net withdrawals are to be expected in the future.

There is also a likelihood that new uses for wood will appear which were not anticipated in the demand estimates. The rapidity of new developments in wood utilization during recent years lends support to an extra allowance for possible increased timber cutting resulting from such developments. A third source of additional withdrawals from inventory is the pressure of a rapidly growing population to convert commercial forest land to other uses. Additional land will be needed for residential development, highways, reservoirs, recreation, and watersheds.

Because inventory is the source of growth, it must be maintained at a level large enough to produce a net growth equivalent to timber cut. If needed growth is no larger than timber cut, the withdrawals from inventory additional to timber cut are not replaced by growth and reduce inventory. These reductions accumulate with time, and the resulting depleted inventory becomes inadequate to produce the growth necessary to sustain needed timber cut. So if inventory is to remain large enough to sustain timber cut, the volume added by growth must be large enough to replace not only timber cut but also withdrawals from inventory expected from catastrophes, unanticipated new uses of wood, and conversion of commercial forest land to other uses. Margins representing given percentages of timber cut under lower projected demands were adopted to account for these three sources of inventory reduction, and the calculated volume was added to both lower and medium projections of timber cut.

Although net losses from catastrophes may decrease somewhat in the future, new uses for wood and conversion of commercial forest land to other uses are more likely to increase with length of the projection period. Because of this, the margins adopted gradually increase from 1953 through 2000 (table 282). Average margins for the entire projection period were 6.5 percent of the cut of sawtimber needed to supply the lower estimate of projected demand and 5.2 percent of the cut needed to supply the medium projected demand. Margins added to the timber cut of growing stock are approximately the same as those shown for sawtimber in table 282.

Timber Removal Rises Sharply

The timber removal necessary to supply medium level demands for sawtimber in 1975 and 2000 will be 68.2 and 105.4 billion board-feet, respectively (table 283). For lower level demands, sawtimber removal in 1975 and 2000 will be 58.8 and 79.3 billion board-feet, respectively. The estimates of timber removal for each demand level are large increases over the timber cut of 48.8 billion board-feet in 1952 (table 284).

Western species would produce a substantial share of total timber removal under both levels of demand. For the first half of the projection period, this share would be about the same proportion of total removal as in 1952, or 46 percent (table 284). However, for the last half of the period, this proportion declines slightly. For example, in 1975 at the medium level of sawtimber demand, removal of western species estimated at 31.7 billion board-feet is still 46 percent of a total removal of 68.2 billion board-feet. In 2000, removal of western species will be 42.8 billion board-feet—41 percent of the 105.4 billion foot total.

Table 282.—*Margins for contingencies, by levels of demand and periods*

Period or year	Margins of sawtimber cut added to cut under—	
	Lower projected demand	Medium projected demand
	Percent	*Percent*
1953	0	0
1953–64	1	1
1965–74	4	3
1975	5	4
1975–84	7	6
1985–99	12	9
2000	15	11
Average	6. 5	5. 2

For eastern hardwoods and eastern softwoods, removal of sawtimber in 1975 at the medium demand level would be nearly equal at about 18 billion board-feet for each species group. At the lower demand level, removal of these two species groups would also be the same in 1975 at 15.7 billion board-feet for each species group. However, by 2000 removal of eastern softwoods at 33.2 billion board-feet for the medium demand level and 24.9 billion board-feet for the lower level would supply higher proportions of total national timber removal than in 1975. Eastern hardwoods would also supply a slightly higher proportion of total removal than in 1975.

These increases for the two eastern species groups offset the decrease for western species and indicate that during the period 1975 to 2000 the East would bear a slightly larger share of timber removal of sawtimber than during the first half of the projection period. Thus, up to the year 2000, western species with heavy volumes of old-growth timber would support more than 40 percent of the total national removal of sawtimber. The west would be supplied about equally by eastern hardwoods and eastern softwoods until 1975; after that, eastern softwoods primarily would

TABLE 283.—*Projected timber cut [1] and timber removal of sawtimber and growing stock, 1975 and 2000, by levels of demand and species groups*

Item	Live sawtimber				Growing stock			
	Total	Eastern hardwoods	Eastern softwoods	Western species	Total	Eastern hardwoods	Eastern softwoods	Western species
Medium level demand:	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*
1975:								
Timber cut [1]	65. 4	17. 7	17. 4	30. 3	14. 0	4. 4	4. 4	5. 2
Margin	2. 8	. 7	. 7	1. 4	. 6	. 2	. 2	. 2
Timber removal	68. 2	18. 4	18. 1	31. 7	14. 6	4. 6	4. 6	5. 4
2000:								
Timber cut [1]	95. 1	26. 5	30. 0	38. 6	19. 7	6. 6	6. 8	6. 3
Margin	10. 3	2. 9	3. 2	4. 2	2. 3	. 8	. 8	. 7
Timber removal	105. 4	29. 4	33. 2	42. 8	22. 0	7. 4	7. 6	7. 0
Lower level demand:								
1975:								
Timber cut [1]	56. 0	15. 0	15. 0	26. 0	12. 4	4. 0	3. 8	4. 6
Margin	2. 8	. 7	. 7	1. 4	. 6	. 2	. 2	. 2
Timber removal	58. 8	15. 7	15. 7	27. 4	13. 0	4. 2	4. 0	4. 8
2000:								
Timber cut [1]	69. 0	19. 3	21. 7	28. 0	15. 7	5. 3	5. 4	5. 0
Margin	10. 3	2. 9	3. 2	4. 2	2. 3	. 8	. 8	. 7
Timber removal	79. 3	22. 2	24. 9	32. 2	18. 0	6. 1	6. 2	5. 7

[1] Timber cut of live timber needed to supply that portion of estimated requirements that must come from domestic sources, derived from the section Future Demand for Timber, tables 278 and 279.

TABLE 284.—*Proportion of timber cut of sawtimber in 1952 and of timber removal in 1975 and 2000, by species groups, and relation of timber removal in 1975 and 2000 to timber cut in 1952, by levels of demand*

Item	Timber cut, 1952		Timber removal				Change in timber removal from 1952 cut	
			1975		2000		1975	2000
Medium level demand:	*Billion bd.-ft.*	*Percent*	*Billion bd.-ft.*	*Percent*	*Billion bd.-ft.*	*Percent*	*Percent*	*Percent*
Eastern hardwoods	12. 2	25	18. 4	27	29. 4	28	+51	+141
Eastern softwoods	14. 1	29	18. 1	27	33. 2	31	+28	+135
Western species	22. 5	46	31. 7	46	42. 8	41	+41	+90
All species	48. 8	100	68. 2	100	105. 4	100	+40	+116
Lower level demand:								
Eastern hardwoods	12. 2	25	15. 7	27	22. 2	28	+29	+82
Eastern softwoods	14. 1	29	15. 7	27	24. 9	31	+11	+77
Western species	22. 5	46	27. 4	46	32. 2	41	+22	+43
All species	48. 8	100	58. 8	100	79. 3	100	+20	+63

increase to offset the proportional decline in western species.

Differences between the three species groups in timber removal of growing stock are not so pronounced as in sawtimber. Eastern forests, with greater area and more timber of pole and seedling and sapling size, are capable of supporting a much larger share of total timber removal of growing stock than are western forests.

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At the medium demand level in 1975, western species will supply 5.4 billion cubic feet of timber removal of growing stock—37 percent of the total, while eastern hardwoods and eastern softwoods will each supply 4.6 billion cubic feet (table 283). By 2000, removal of growing stock of western species will have risen to 7.0 billion cubic feet, but this is 32 percent of the national total. Eastern hardwoods and eastern softwoods will each supply

about 7.5 billion cubic feet of growing stock or 34 percent of the total in 2000.

The comparisons just made show the changes in relative use of the species groups which are anticipated by demand projections. Additional comparisons between the timber cut for 1952 and timber removal for 1975 and 2000 indicate the changes in timber removal needed to supply projected demands.

If medium demands for sawtimber are to be supplied, timber removal of all species will need to exceed 1952 timber cut by 40 percent in 1975 and by 116 percent in 2000 (table 284). Corresponding increases needed to supply lower projected demands are 20 percent in 1975 and 63 percent in 2000.

Timber removal of eastern hardwood sawtimber under medium projected demands exceeds 1952 timber cut by 51 percent in 1975 and by 141 percent in 2000. These percentage increases are larger than those for either eastern softwoods or western species. A similar relation exists for lower projected demands. This relation results from changes anticipated in relative use of the three species groups. For example, demand projections translated to timber removal indicate that relative use of eastern hardwoods increases from 25 percent of timber cut in 1952 to 28 percent of timber removal in 2000 while relative use of eastern softwoods and western species combined declines from 75 percent of timber cut in 1952 to 72 percent of timber removal in 2000 (table 284).

Large increases in timber removal of eastern softwood sawtimber are also indicated. Under medium demands, timber removal exceeds 1952 timber cut by 28 percent and 135 percent in 1975 and 2000, respectively. Corresponding increases under lower demands are 11 percent in 1975 and 77 percent in 2000.

Under medium demands, the increase in timber removal of western species—41 percent more than 1952 timber cut—is considerably greater than the increase indicated for eastern softwoods. By 2000 the increase of 90 percent for western species is much less than the corresponding increase indicated for both eastern softwoods and eastern hardwoods. This change in relations between 1975 and 2000 reflects the changing ability of the species groups to support removal.

Under lower demands increases in timber removal of western species over 1952 timber cut are 22 percent and 43 percent for 1975 and 2000, respectively. The relation between these increases for western species and those for eastern softwoods and eastern hardwoods are similar to the relations existing under medium projected demands.

Comparisons between timber removal and 1952 timber cut of growing stock are similar to those for sawtimber, both as to magnitude of increases indicated and in the relations between species groups.

Needed Growth Much Larger Than Growth in 1952

Medium Projections

For all species groups combined, the growth of sawtimber needed to sustain medium projected demands in 1975 is 44 percent more than the 1952 net growth of 47.4 billion board-feet (table 285). The increase in needed growth by 2000 is 122 percent of growth in 1952. With these increases, industrial wood could hold its present position in the national economy, per capita consumption would rise, and trends in future prices of timber products would be generally parallel to trends in prices of competing materials.

Although needed growth of eastern hardwood sawtimber in 1975 is slightly less than 1952 growth, an increase of 52 percent will be required by 2000 (fig. 133). Growth of eastern softwoods needs to increase 66 percent by 1975 and 154 percent by 2000. The largest increases needed are for the western species—92 percent and 194 percent in 1975 and 2000, respectively.

TABLE 285.—*Relation of needed growth in 1975 and 2000 to net growth in 1952, by levels of demand and species groups* [1]

Item	Sawtimber		Growing stock	
	Needed growth	Change from 1952	Needed growth	Change from 1952
Medium level demand:	*Billion bd.-ft.*	*Percent*	*Billion cu. ft.*	*Percent*
1975:				
Eastern hardwoods	18.3	−4	4.5	−36
Eastern softwoods	28.2	+66	5.7	+30
Western species	21.7	+92	4.4	+57
All species	68.2	+44	14.6	+3
2000:				
Eastern hardwoods	29.1	+52	7.3	+4
Eastern softwoods	43.1	+154	8.3	+89
Western species	33.2	+194	6.4	+129
All species	105.4	+122	22.0	+55
Lower level demand:				
1975:				
Eastern hardwoods	15.6	−18	4.1	−41
Eastern softwoods	24.4	+44	5.0	+14
Western species	18.8	+66	3.9	+39
All species	58.8	+24	13.0	−8
2000:				
Eastern hardwoods	22.0	+15	6.0	−14
Eastern softwoods	32.3	+90	6.8	+55
Western species	25.0	+121	5.2	+86
All species	79.3	+67	18.0	+27

[1] See table 281 for growth in 1952 and realizable growth.

Figure 133

In 2000, the needed growth of 105.4 billion board-feet of all species is at about the same general level as the realizable growth of 100.7 billion. The small difference between the two estimates is probably not significant in a statistical sense, and the comparison indicates that the growth necessary to permanently sustain medium level demands for sawtimber in 2000 is about the same as the growth that would be attained in due course if all commercial forest land, on the average, was placed under the better forest management in effect at the present time. Needed growth of eastern hardwood sawtimber is slightly less than realizable growth of this species group. However, needed growth of eastern softwoods and western species by 2000 exceeds realizable growth by 3.5 and 2.6 billion board-feet, respectively.

The comparison of realizable growth and needed growth suggests that if medium level demands for sawtimber are to be supplied permanently the intensity of forestry must be greatly increased. On lands best able to adopt improved methods, the intensity of forestry must exceed the better present day practices in order to balance the deficiencies of needed growth on lands where such practices will not be attained.

Growth of eastern hardwood growing stock in 1952 is considerably more than enough to satisfy needed growth in 1975 but falls slightly short by 2000 when a 4-percent increase will be needed. Increases in needed growth of eastern softwood growing stock are 30 percent for 1975 and 89 percent for 2000. For western species, corresponding increases are 57 percent and 129 percent. For all species groups combined, increases in needed growth of growing stock are 3 percent in 1975 and 55 percent in 2000.

Realizable growth of growing stock exceeds needed growth in the year 2000 for all three species groups. This indicates the likelihood that medium level demands for products made from trees below sawtimber size can be met more easily than demands for products requiring sawtimber. Nevertheless, because more than 80 percent of total demand requires trees of sawtimber size, sustaining projected demands depends largely on producing needed growth of sawtimber rather than needed growth of growing stock.

Lower Projections

Estimates of demand at the lower level reflect a continued decline in per capita consumption of industrial wood as a whole, and also a decline in the use of wood in relation to competing materials. Moreover prices of industrial wood would rise faster than prices of competing materials.

At this lower level of demand, needed growth of sawtimber in 1975 will be 24 percent more than growth in 1952 and 67 percent more in 2000 (table 285). Needed growth of eastern hardwoods in

1975 will be less than 1952 growth, but by 2000 an increase of 15 percent will be necessary. In 1975 needed growth of eastern softwoods will be 44 percent more than growth in 1952, and in 2000 the required increase will be 90 percent. Needed increases in sawtimber growth of western species will be 66 percent in 1975 and 121 percent in 2000. Consequently, even with increases in price and declines in per capita consumption and the relative use of wood, demands resulting from increases in population and from a growing economy will require substantially more growth in future years than was available in 1952.

If total projected demands for timber products are to be met and sustained, needed growth must not only be sufficient but it must be balanced with respect to demands for species. This is particularly important for eastern softwoods and western species which are primarily softwood, because hardwood and softwood species are not readily interchangeable for many important uses.

Realizable growth of sawtimber exceeds the lower level of needed growth in 2000 for each species group. And for all species combined, realizable growth of 100.7 billion board-feet exceeds needed growth of 79.3 billion board-feet. Even so, this means that nearly 80 percent of realizable growth of sawtimber will be required to sustain the lower level of needed growth in 2000.

For growing stock, the 1952 growth of 14.2 billion cubic feet exceeds needed growth in 1975 by 1.2 billion cubic feet. This surplus growth, however, is based on totals of all species groups and is due to a 1952 growth of 7.0 billion cubic feet of eastern hardwoods compared to needed growth of 4.1 billion cubic feet for that species group in 1975. To attain the lower level of needed growth for other species groups in 1975, increases of 14 percent for eastern softwoods and 39 percent for western species will be needed.

By 2000, a 27-percent increase will be required to attain the needed growth of growing stock for all species groups. Growth of eastern hardwoods in 1952 is somewhat larger than needed growth in 2000, but increases of 55 percent and 86 percent will be needed for eastern softwoods and western species, respectively.

Realizable growth of growing stock for each species group exceeds needed growth in 2000 for each group. The needed growth of 18.0 billion cubic feet for all species groups in that year indicates that about two-thirds of realizable growth will be required to sustain the lower level of needed growth of growing stock.

Needed Growth and Timber Removal Unbalanced by Species Group

Changes in the proportion of total national removal of sawtimber contributed by each of the species groups are not large enough to materially alter the relative importance of each group (table 284). Thus, western species with 70 percent of the national sawtimber inventory in 1953 would account for more than 40 percent of the total national removal of sawtimber during the rest of this century.

Realizable growth of western species, however, is only 30 percent of total realizable growth (table 281). Moreover, neither the old-growth timber that remains uncut nor the young timber that will be established on areas of old growth harvested after 1952 can contribute materially to needed growth during the rest of this century. So, if either medium or lower levels of demand for sawtimber are to be supplied until 2000, timber removal of western species will necessarily exceed needed growth (table 286).

In contrast to western species, eastern softwoods are rapidly growing young timber with 12 percent of the national sawtimber inventory in 1953 and about 40 percent of realizable growth. By 2000 they would be in a position to produce about 30 percent of timber removal and 40 percent of needed growth at either level of demand.

Table 286.—*Needed growth and corresponding timber removal, 1975 and 2000, by levels of demand and species groups*

Item	Sawtimber		Growing stock	
	Timber removal	Needed growth	Timber removal	Needed growth
Medium level demand:	*Billion*	*Billion*	*Billion*	*Billion*
1975:	*bd.-ft.*	*bd.-ft.*	*cu. ft.*	*cu. ft.*
Eastern hardwoods	18. 4	18. 3	4. 6	4. 5
Eastern softwoods	18. 1	28. 2	4. 6	5. 7
Western species	31. 7	21. 7	5. 4	4. 4
All species	68. 2	68. 2	14. 6	14. 6
2000:				
Eastern hardwoods	29. 4	29. 1	7. 4	7. 3
Eastern softwoods	33. 2	43. 1	7. 6	8. 3
Western species	42. 8	33. 2	7. 0	6. 4
All species	105. 4	105. 4	22. 0	22. 0
Lower level demand:				
1975:				
Eastern hardwoods	15. 7	15. 6	4. 2	4. 1
Eastern softwoods	15. 7	24. 4	4. 0	5. 0
Western species	27. 4	18. 8	4. 8	3. 9
All species	58. 8	58. 8	13. 0	13. 0
2000:				
Eastern hardwoods	22. 2	22. 0	6. 1	6. 0
Eastern softwoods	24. 9	32. 3	6. 2	6. 8
Western species	32. 2	25. 0	5. 7	5. 2
All species	79. 3	79. 3	18. 0	18. 0

It seems apparent that balances between timber removal and needed growth for western species and eastern softwoods will not be possible by 2000 if demands for timber are met at either of the two levels. The major objective of producing sufficient needed growth to sustain timber removal can be reached on a national basis only to the extent that an unavoidable deficit in needed growth of western species can be balanced by a growth surplus of eastern softwoods.

For eastern hardwoods, realizable growth exceeds the needed growth necessary to support timber removal at either level of demand. With softwoods occupying the key position in the national timber economy, it is essential that a surplus growth of eastern softwoods be maintained until adjustments in western forests, discussed next, are completed. This is perhaps the most important finding resulting from comparisons of needed growth and timber removal.

Adjustments of Inventory Essential

Current inventories of live standing timber will require major adjustments if needed growth is to be reached and sustained. The needed inventory of standing sawtimber for all species groups combined should increase about one-third by 2000 if medium level demands are to be sustained (table 287). This total adjustment obscures the proportionately greater inventory increases that are needed for eastern species groups and the reduction indicated for western species. For example, if the sawtimber inventory in 2000 is to produce the growth needed to sustain medium level demands, there must be inventory increases of 300 percent for eastern softwoods and 100 percent for eastern hardwoods. In contrast, the inventory of western species could be about one-fourth less than the 1953 inventory if age-class adjustments are accomplished.

For the lower level of demand, the inventory necessary to sustain needed growth of sawtimber in 2000 will be 8 percent less than the 1953 inventory. For individual species groups inventory increases of 147 percent for eastern softwoods and 32 percent for eastern hardwoods would be needed while a decrease of 45 percent for western species could still produce the needed growth.

The reduced inventories indicated for western species will produce the needed growth only if adjustments in the condition of the inventory accompany the reductions. For example, 41 percent of all commercial forest land and two-thirds of the area in sawtimber stands in the West and Coastal Alaska together, consist of old-growth timber stands (see appendix, Basic Statistics, table 20). These contain much overmature and decadent timber, mortality is high, and net growth very low.

The needed growth of western species cannot be produced and sustained until the old growth is harvested and replaced by thrifty, rapidly growing timber with individual trees or stands of all ages more equally distributed than at present. Although prompt and adequate replacement of western old growth is vital to attainment of needed growth, it will inevitably result in reductions of inventory during the rest of this century. A contrasting situation exists in the East. Here inventories are already depleted because of heavy

TABLE 287.—*Relation of timber inventory in 1953 to needed inventory, 1975 and 2000, by levels of demand and species groups*

Item	Live sawtimber					Growing stock				
	Inventory 1953	Needed inventory		Change from 1953		Inventory 1953	Needed inventory		Change from 1953	
		1975	2000	1975	2000		1975	2000	1975	2000
	Billion bd.-ft.	*Billion bd.-ft.*	*Billion bd.-ft.*	*Percent*	*Percent*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Percent*	*Percent*
Medium level demand:										
Eastern hardwoods	381	482	769	+27	+102	151	114	186	−25	+23
Eastern softwoods	242	635	970	+162	+301	74	124	181	+68	+145
Western species	1, 434	691	1, 057	−52	−26	292	178	260	−39	−11
All species	2, 057	1, 088	2, 796	−12	+36	517	416	627	−20	+21
Lower level demand:										
Eastern hardwoods	381	358	503	−6	+32	151	104	152	−31	+1
Eastern softwoods	242	449	598	+86	+147	74	110	147	+49	+99
Western species	1, 434	597	793	−58	−45	292	158	212	−46	−27
All species	2, 057	1, 404	1, 894	−32	−8	517	372	511	−28	−1

cutting that accompanied the early and rapid growth of population and industry. Needed growth of eastern species groups can be produced only by building up these depleted inventories.

High-Quality Timber Will Still Be Needed

Previous discussion of needed growth and inventory was limited to consideration of timber volume. The quality of the growth and inventory necessary to meet projected demands is also important, but no single standard of quality is possible because of the wide variety of products made from wood. For that reason, future demands for high-quality timber can be discussed only in general terms.

In recent years, many advances in the technology of wood utilization have made possible the production of good quality products from wood of low-quality logs and bolts. New glues, gluing methods, and other techniques, for example, make it possible to use low-quality lumber for laminated products of widely varied shapes and sizes. Nevertheless, good laminated arches, ship timbers, and other structural members cannot be made from wood of nondescript quality. Even the inner laminations for most structural members must meet certain requirements for density and strength and be relatively free of knots, steep cross grain, and other strength-reducing characteristics.

The rapid expansion of the pulp, paper, and wood-fiber industries is sometimes interpreted as indicating a revolutionary shift to uses of wood where high quality is not needed. Even so, fiber length, strength, felting properties, uniformity of raw material, and other quality characteristics are extremely important in the making of many such products.

Projections in the section Future Demand for Timber provide indications of trends in future demand for high-quality wood. Such indications cannot include all uses of high-quality wood, because demands are projected in terms of total volume for some products in which both high and lower quality wood is used but with the volume of high-quality wood unknown. Examples are cooperage and poles and piling. However, an indication of trends can be derived from projections of demand for furniture, "other manufactured products," veneer and plywood, millwork, and siding which are products requiring that the basic wood supply consist largely of high-quality material. With substantial allowances for substitution of other materials for lumber, medium projections for these selected products show that demand would exceed 1952 consumption by more than 60 percent in 1975 and by about 140 percent in 2000 (table 288). Even though the proportion of high-quality wood used in these products may be reduced by future technological developments, the indications are for increasing rather than declining demands for high-quality wood.

Although tree size takes no account of many important characteristics of wood, it reflects quality in a general way and is the most comprehensive standard available for estimates of future quality demands. The distinction between sawtimber and growing stock is a basis for separating

Table 288.—*Consumption in 1952 and projected medium demand in 1975 and 2000 for industrial wood used in selected products requiring substantial amounts of high-quality wood*

Item	Consumption 1952	Projected demand		Change from 1952	
		1975	2000	1975	2000
	Billion bd.-ft.	*Billion bd.-ft.*	*Billion bd.-ft.*	*Percent*	*Percent*
Furniture [1]	1.9	2.7	3.3	+42	+74
Other manufactured products [2]	2.0	2.9	4.7	+45	+135
Millwork	[3] 1.9	[4] 2.8	[4] 3.9	+47	+105
Siding [5]	.7	1.0	1.2	+43	+71
Veneer and plywood: [6]					
Hardwood	1.0	1.7	3.0	+70	+200
Softwood	1.6	3.9	6.0	+144	+275
Total	2.6	5.6	9.0	+115	+246
Total	9.1	15.0	22.1	+65	+143

[1] Assumes that lumber use per dollar's worth of furniture output (at constant 1953 prices) will decrease by 11 percent during the period 1952–75 and by 19 percent during the period 1952–2000.

[2] Assumes that lumber use per dollar's worth of products output (at constant 1953 prices) will decrease by 11 percent in the period 1952–75 and by 16 percent during the period 1952–2000.

[3] Estimate based on reported consumption of lumber by millwork plants, Census of Manufacturers, 1954, adjusted to 1952 on the assumption that numbers of production workers reported as employed by millwork plants in 1952 and 1954 were in direct proportion to volume of lumber consumed.

[4] Includes millwork for both residential and nonresidential construction. For residential construction, assumes that volume of millwork for dwellings (estimated at 1 thousand board-feet in 1952 on basis of reports by Stanford Research Institute and Housing and Home Finance Agency) would decrease by 10 percent during the period 1952–75 and by 12 percent during the period 1952–2000. For nonresidential construction the corresponding decreases assumed were 15 percent and 25 percent.

[5] Based on number of single family dwellings built in 1952 and projected demand for single family dwellings in 1975 and 2000. Volume of siding used per unit (600 board-feet in 1952, derived from "The Materials Use Survey, Housing and Home Finance Agency, 1950") assumed to decrease 10 percent during the period 1952–75 and 12 percent during the period 1952–2000.

[6] Log scale, International ¼-inch rule.

future demands into two broad size or quality classes. On this basis 84 percent of the timber cut from growing stock in 1952 consisted of sawtimber (table 289). Although a slight decline in this proportion is anticipated by 2000, more than 80 percent of projected demands will require trees of sawtimber size.

TABLE 289.—*Proportion of timber cut represented by sawtimber in 1952, 1975, and 2000* [1]

Year and demand level	Total timber cut	Sawtimber cut	Sawtimber cut in relation to total cut
	Billion cu. ft.	*Billion cu. ft.*	*Percent*
1952	10. 76	9. 07	84
1975:			
Medium level	13. 99	11. 64	83
Lower level	12. 43	10. 33	83
2000:			
Medium level	19. 71	16. 16	82
Lower level	15. 66	12. 83	82

[1] Summarized from table 81, of Basic Statistics in appendix.

Trees under sawtimber size included in growing stock do not lend themselves to the manufacture of lumber, veneer, and many other products. This is because they are frequently knotty or have other undesirable quality characteristics, and the yield of usable material is low per unit of volume handled. Cost of logging and manufacture of such trees is also higher per unit of volume output than for larger trees. The same limitations apply in part to the smaller trees included under the definitions of sawtimber used in this report.

Within these limitations, the needed growth of sawtimber is the best available expression that combines consideration of both the quality and volume required to sustain estimated demands for the majority of products. On the other hand, needed growth of growing stock takes no account of size distinctions, and attainment of it could leave unsatisfied demands for many important products.

GROWTH AND INVENTORY EXPECTED IF PROJECTED DEMANDS ARE MET AND FORESTRY TRENDS CONTINUE

Estimates of the growth and inventory needed to sustain lower and medium level demands have already been discussed. Comparisons of realizable growth with needed growth have shown that both medium and lower level demands are within reach. To complete the timber outlook picture, comparisons are now made between the supplies of timber needed (needed growth and inventory) and the supplies that would be available in future years under certain assumptions (projected growth and inventory).

The growth and inventory of the future will result from the interplay of the following four factors: (a) the 1953 inventory, (b) additions to this inventory by growth (including ingrowth), (c) subtractions from the inventory by timber removal, and (d) subtractions due to losses caused by destructive agents, grouped under the term "mortality," and not included in timber removal. These four factors are known quantities for the base year 1953. However, projected growth and inventory can be developed only by estimating future values for growth rates, timber removal, and mortality rates on the basis of broad trends assumed to prevail during the period 1953–2000.

The trends assumed for estimates of projected growth under each demand level are (1) that annual timber removal will climb steadily from 1952 to meet the removal necessary to supply demands each year until 2000 (table 283), and (2) progress in forestry will continue as indicated by recent trends so that by 2000 it will be considerably more widespread and intensive than in 1952.

Under these assumptions, projected net growth (including ingrowth), mortality, and inventory were calculated by projection periods for each of the 13 regions recognized in this report. The initial years of the projection periods used were 1953, 1965, 1975, and 1985. Regional calculations of projected net growth plus mortality for the initial year of each projection period were summarized for the three species groups, and for all species combined, and expressed as percentages of the corresponding projected inventories.

Under lower level demands, the gross growth rates thus derived for all species combined changed from 3.0 percent in 1953 to 3.7 percent in 1985, an increase in growth rate of 23 percent (table 290). Growth rates under the medium level projection were slightly higher because the larger volume of timber removed under this projection would result in inventories of generally younger trees with higher growth rates than would timber removal at the lower level.

Increasing growth rates were adopted for western species because of expectations that (1) improved forest practices will become more intensive and widespread than at present and (2) rapidly growing young stands now under sawtimber size will develop into sawtimber in increasing amounts during the projection period while continued cutting of old growth will reduce the area of very slow growing timber. Thus, the growth rate for western species in the initial year of the last projection period, 1985, is 53 percent higher than the 1953 rate at the lower level of demand (table 290).

TABLE 290.—*Rates of mortality and gross growth of sawtimber for the initial year of projection periods, by levels of demand and species groups*

Demand level and species group	Gross growth rate [1]			1985 rate in relation to 1953 rate	Mortality rate			1985 rate in relation to 1953 rate
	1953	1975	1985		1953	1975	1985	
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Lower level:								
Eastern hardwoods	5. 76	5. 01	4. 55	−21	0. 60	0. 47	0. 45	−25
Eastern softwoods	8. 05	7. 39	6. 80	−16	. 66	. 48	. 45	−32
Western species	1. 44	1. 95	2. 21	+53	. 63	. 55	. 52	−17
All species	3. 00	3. 58	3. 70	+23	. 63	. 52	. 49	−22
Medium level:								
Eastern hardwoods	5. 76	5. 13	4. 69	−19	. 60	. 47	. 45	−25
Eastern softwoods	8. 05	7. 64	7. 35	−9	. 66	. 49	. 47	−29
Western species	1. 44	1. 97	2. 26	+57	. 63	. 54	. 52	−17
All species	3. 00	3. 63	3. 74	+25	. 63	. 51	. 49	−22

[1] Includes ingrowth.

Eastern forests consist largely of young trees growing at rapid rates. As the inventory builds up in accordance with expected forestry trends and as these forests become older, the volume of growth will increase but rates of growth will decline. This decline is in accord with well-established knowledge of the relationships between the growth rates and the ages of forest stands. Thus, growth rates for eastern hardwoods and eastern softwoods in 1975 and 1985 are lower than the 1953 rates.

Mortality rates, derived by procedures similar to those used for rates of gross growth, reflect expectations of steadily declining losses from fire, insects, disease, and other natural causes. For all species combined, the mortality rate of 0.63 percent in 1953 drops to 0.49 percent in 1985, a decrease of 22 percent.

These changes in rates of gross growth and mortality are an overall expression of the allowances made in projections for the increased intensity of forestry expected from continuation of recent trends.

Projected Growth Compared to 1952 Growth

Growth Declines Under Medium Level Demands After 1975

With medium level demands met each year and with forestry progressing as indicated by recent trends, projected growth of sawtimber will rise from 47.4 billion board-feet in 1952 to 58.6 billion board-feet in 1975—an increase of 24 percent (table 291). In 1975 projected growth of both eastern hardwoods and eastern softwoods is 18 percent more than in 1952, while western species increase 41 percent.

Timber removal at the medium level would increase from 68.2 billion board-feet in 1975 to 105.4 billion board-feet in 2000. During this period the large and rapidly increasing timber removal would exceed growth by successively larger amounts, and the accompanying reduction of inventory would result in a sharp decline in growth late in the century. When growth projection calculations are followed through after 1975 under the basic assumptions, a decrease of 47 percent in sawtimber growth of all species by 2000 is indicated (table 291). Growth of eastern hardwoods would be 36 percent less in 2000 than in 1952, growth of eastern softwoods would be negligible, and growth of western species would increase 15 percent.

These statistics are useful chiefly to show that the progress in forestry indicated by recent trends will fall far short of supplying medium level demands. In all probability, economic factors not included in the basic assumptions will become operative at some time prior to 2000 and not only reduce timber removal below the level needed to supply projected demands but also raise growth above the calculated volumes. These factors are discussed under the heading Needed Growth Compared to Projected Growth.

In terms of growing stock, projections indicate that growth in 1975 would be 19 percent more and in 2000, 14 percent less than growth in 1952. Growth of eastern softwoods would rise slightly between 1952 and 1975 but by 2000 would be 86 percent less than 1952 growth. By 2000, projected growth of eastern hardwoods and western species is 13 percent and 32 percent, respectively, above 1952 growth. Although these projected trends appear more favorable than those for

TABLE 291.—*Relation of net growth 1952 to projected growth 1975 and 2000, by levels of demand and species groups*

Item	Live sawtimber: Net growth 1952	Live sawtimber: Projected net growth 1975	Live sawtimber: Projected net growth 2000	Live sawtimber: Change from 1952, 1975	Live sawtimber: Change from 1952, 2000	Growing stock: Net growth 1952	Growing stock: Projected net growth 1975	Growing stock: Projected net growth 2000	Growing stock: Change from 1952, 1975	Growing stock: Change from 1952, 2000
	Billion bd.-ft.	*Billion bd.-ft.*	*Billion bd.-ft.*	*Percent*	*Percent*	*Billion cu. ft.*	*Billion cu. ft.*	*Billion cu. ft.*	*Percent*	*Percent*
Medium level demand:										
Eastern hardwoods	19. 1	22. 6	12. 2	+18	−36	7. 0	8. 7	7. 9	+24	+13
Eastern softwoods	17. 0	20. 1	(1)	+18	−(2)	4. 4	4. 6	. 6	+5	−86
Western species	11. 3	15. 9	13. 0	+41	+15	2. 8	3. 6	3. 7	+29	+32
All species	47. 4	58. 6	25. 2	+24	−47	14. 2	16. 9	12. 2	+19	−14
Lower level demand:										
Eastern hardwoods	19. 1	24. 1	25. 6	+26	+34	7. 0	9. 1	9. 4	+30	+34
Eastern softwoods	17. 0	20. 7	23. 0	+22	+35	4. 4	5. 4	5. 5	+23	+25
Western species	11. 3	16. 3	18. 1	+44	+60	2. 8	3. 7	4. 2	+32	+50
All species	47. 4	61. 1	66. 7	+29	+41	14. 2	18. 2	19. 1	+28	+35

[1] Negligible.

[2] Because projected growth is negligible, the theoretical percentage change would approach a minus 100 percent.

growth of sawtimber, they show only that medium level demands for products that require pole timber would be more easily met than demands for products that require sawtimber.

Lower Level Demand Results in Growth Increase

Under assumptions of the lower demand level, projected sawtimber growth will increase steadily from 47.4 billion board-feet in 1952 to 66.7 billion board-feet in 2000 (table 291). This increase of 41 percent contrasts sharply with the decrease in growth projected under medium level demand assumptions. Projected growth of both eastern softwoods and eastern hardwoods in 2000 will be about one-third greater than growth in 1952, while the increase for western species will be 60 percent.

Projected growth of growing stock in 2000 will be 19.1 billion cubic feet, compared with the 1952 growth of 14.2 billion. For western species, the increase in projected growth is 50 percent of 1952 growth. Increases in projected growth for eastern hardwoods and eastern softwoods will be 34 percent and 25 percent, respectively.

The marked contrast in projected growth for medium and lower demand levels is attributable to large differences in timber removal, since assumptions as to progress in forestry were identical. Timber removal at the medium level exceeds removal at the lower level by ever increasing amounts. In 1975, the timber removal of 68.2 billion board-feet needed to supply medium level demands for sawtimber is about 9 billion board-feet more than the removal of 58.8 billion board-feet necessary to satisfy lower level demands (table 283). By 2000, timber removal under the medium level demand would be 105.4 billion board-feet, or 26 billion board-feet more than the lower level estimate of 79.3 billion board-feet. An increasing excess of timber removal coupled with a projected growth less than removal for the entire projection period results in rapid inventory reductions under medium demands and a consequent declining ability of the reduced inventory to produce growth.

Needed Growth Compared to Projected Growth

The comparison of trends of projected growth with growth in 1952, just presented, is of much less significance than the relation between projected growth and the growth needed to sustain estimated demands. In the following paragraphs comparisons are made between needed growth and projected growth for the medium and lower demand levels. These comparisons are the most important presented in this section, and they provide the basis for judging the relative ease or difficulty of supplying projected demands during the remainder of this century.

Medium Level Projected Growth Far Short of Needed Growth

Although projected growth of sawtimber under medium level demand assumptions increases for a time after 1952, it fails to keep pace with needed

growth and by 1975 is 14 percent less than the growth needed to sustain demands (table 292). For both eastern softwoods and western species, projected growth falls short of needed growth by 29 percent and 27 percent, respectively. For eastern hardwoods, projected growth is more than enough to meet medium level demands in 1975.

After 1975, the sharp drop in projected growth would be accompanied by increasing scarcity of some species and some kinds of products, prices would rise and consumption slacken. The reduced timber removal would tend to modify the decline in projected growth. Price increases and the existence of obvious scarcities would stimulate more intensive forestry. This, in turn, would also eventually increase growth above the trends indicated by projections. For these reasons, it is likely that timber removal will fall below the level needed to supply projected demands for sawtimber, and growth will not decline as sharply as projections indicate (fig. 134).

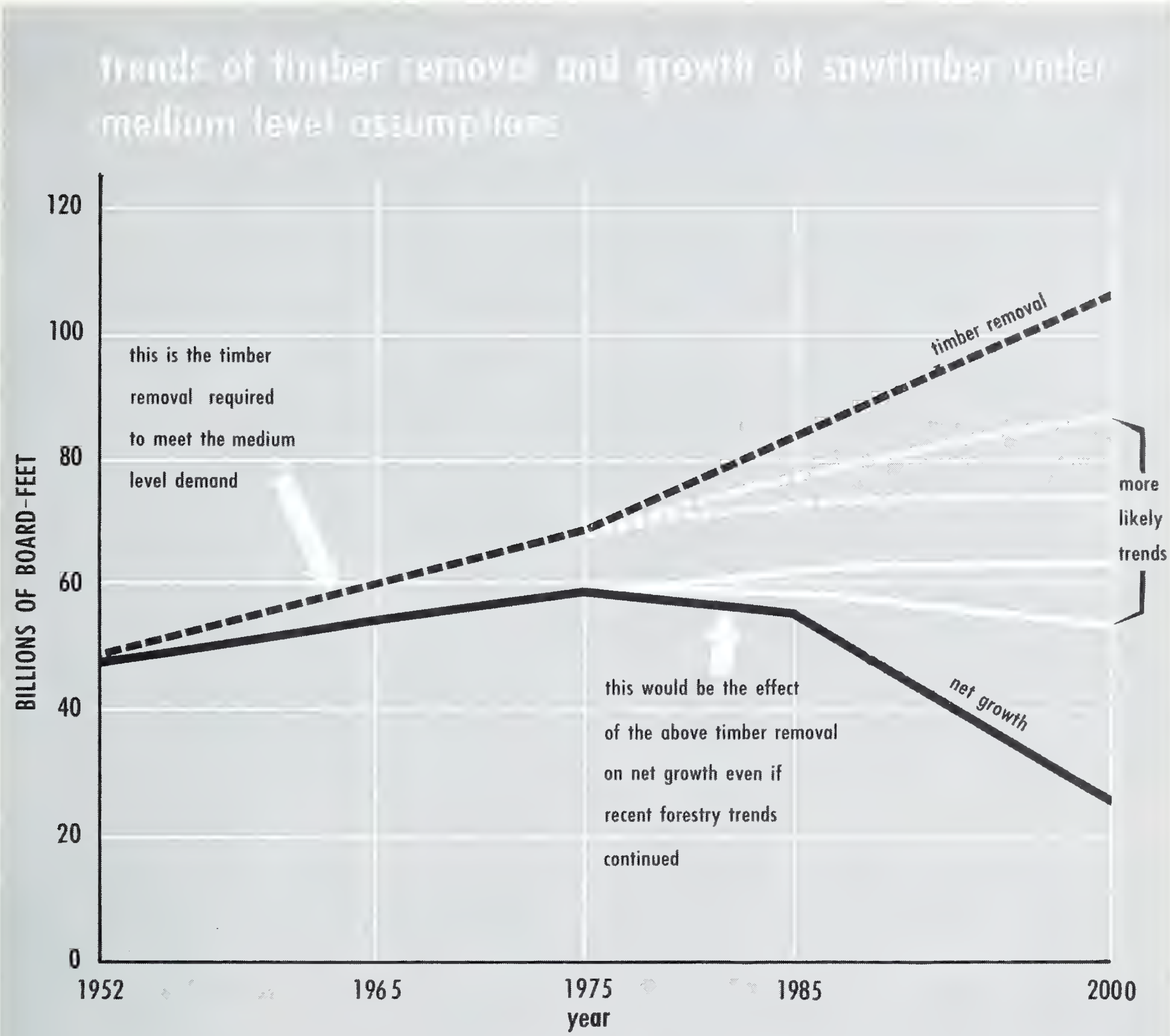
The time at which these more likely trends would occur and the extent to which timber removal and projected growth would be affected are difficult to estimate. However, consideration of both the projections and the more likely trends indicate that demands at the medium level cannot be met and sustained unless forestry is intensified far beyond what can be expected from continuation of recent forestry trends. Moreover, since the effects of forestry on growth are long delayed, early achievement of such intensification is essential if medium level demands are to be sustained.

Growth trends projected for growing stock are similar to those for sawtimber although not so pronounced. In 1975 projected growth would exceed needed growth by 16 percent but by 2000 would be 45 percent less than needed growth. Although projected growth of eastern hardwoods exceeds needed growth in both 1975 and 2000, projected growth of both eastern softwoods and western species is about 20 percent less than needed growth in 1975 with still greater deficits by 2000.

TABLE 292.—*Relation of projected growth to needed growth 1975 and 2000, by levels of demand and species groups*

Item	Live sawtimber			Growing stock		
	Projected growth	Needed growth	Projected in relation to needed	Projected growth	Needed growth	Projected in relation to needed
Medium level demand:	*Billion bd.-ft.*	*Billion bd.-ft.*	*Percent*	*Billion cu. ft.*	*Billion cu. ft.*	*Percent*
1975:						
Eastern hardwoods	22. 6	18. 3	+23	8. 7	4. 5	+93
Eastern softwoods	20. 1	28. 2	−29	4. 6	5. 7	−19
Western species	15. 9	21. 7	−27	3. 6	4. 4	−18
All species	58. 6	68. 2	−14	16. 9	14. 6	+16
2000:						
Eastern hardwoods	12. 2	29. 1	−58	7. 9	7. 3	+8
Eastern softwoods	(1)	43. 1	−(2)	. 6	8. 3	−93
Western species	13. 0	33. 2	−61	3. 7	6. 4	−42
All species	25. 2	105. 4	−76	12. 2	22. 0	−45
Lower level demand:						
1975:						
Eastern hardwoods	24. 1	15. 6	+54	9. 1	4. 1	+122
Eastern softwoods	20. 7	24. 4	−15	5. 4	5. 0	+8
Western species	16. 3	18. 8	−13	3. 7	3. 9	−5
All species	61. 1	58. 8	+4	18. 2	13. 0	+40
2000:						
Eastern hardwoods	25. 6	22. 0	+16	9. 4	6. 0	+57
Eastern softwoods	23. 0	32. 3	−29	5. 5	6. 8	−19
Western species	18. 1	25. 0	−28	4. 2	5. 2	−19
All species	66. 7	79. 3	−16	19. 1	18. 0	+6

[1] Negligible.
[2] Because projected growth is negligible, the theoretical difference would approach a minus 100 percent.



If the assumptions basic to this projection prevail for the next two or three decades, timber removal and net growth thereafter will more closely approach each other than indicated by the heavy lines above. Trends toward limited supplies resulting from inadequate growth will reduce timber removal below amounts needed to supply projected demands. On the other hand higher prices caused by limitations in supply will stimulate forestry and the decline in growth would be modified by this and reduced removal.

Figure 134

Lower Level Demands Can Be Sustained for Some Time

Under lower level assumptions, comparisons of projected growth and needed growth indicate that potential demands can be met for some time. Projected sawtimber growth would increase slowly to the end of the century and would exceed needed growth by 4 percent in 1975 (table 292). In 2000, however, projected growth would be 16 percent less than needed growth, and the gap would be widening (fig. 135). Moreover, this comparison for all species groups combined hides important growth deficits for eastern softwoods and western species since projected growth for eastern hardwoods exceeds needed growth in both 1975 and

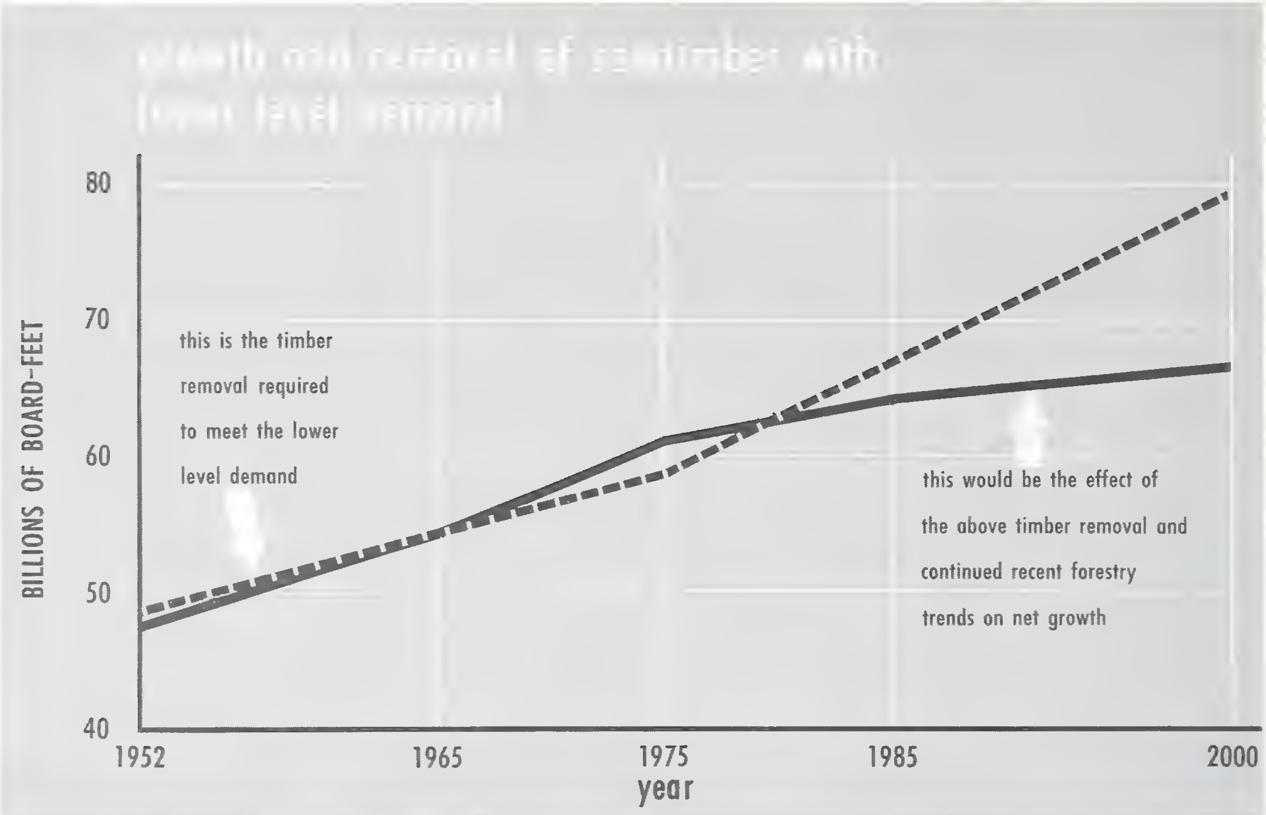


Figure 135

2000. Projected growth of both eastern softwoods and western species would be about 15 percent less than needed growth in 1975 and about 30 percent less in 2000.

The surplus of hardwood sawtimber growth suggests that softwood deficits through 1975 could be reduced by substitution of hardwoods. To the extent that it can be foreseen, substitution of hardwoods for softwoods was made in projecting demands for timber products (see section on Future Demand for Timber). A still greater use of hardwoods would mean early and significant shifts to them in construction and other uses for which softwoods have been long established as the superior material. Such a degree of increased substitution would require a rapid and material change in the wood-using habits of the Nation.

Trends of projected growth and needed growth after 1975 lead to a deficit of more than 12 billion board-feet by 2000 and indicate that lower level assumptions may eventually result in a decline of timber supplies similar to that projected for the medium level.

In summarizing sawtimber relations these comparisons of projected growth and needed growth indicate that (a) through 1975, lower level demands can be met reasonably well but at the risk of growing shortages, particularly in softwood supplies; and (b) an increasing growth deficit will begin after 1975 and may result in more significant shortages of softwoods before 2000 and of all species groups thereafter, unless forestry trends can be accelerated beyond those expected from recent forestry developments.

For growing stock, projected growth at the lower level of demand will exceed needed growth for the rest of this century, although the growth surplus of 40 percent in 1975 will shrink to 6 percent by 2000. Projected growth of eastern hardwood growing stock will remain substantially higher than needed growth in both 1975 and 2000, but by 2000 projected growth of both eastern softwoods and western species will be 19 percent less than needed growth. Thus, future growth trends for growing stock are similar to those for sawtimber, but deficits in the growth of softwoods are smaller and the prospects of softwood shortages, although present, are less acute than for sawtimber.

Sustained Removal Falls Below Lower Level Demands

The growth relations presented thus far show that the intensity of forestry expected from continuation of recent trends will not produce sufficient growth to meet and sustain demands at either the medium or lower levels to the end of the century. However, the approximate balance between projected growth and needed growth through 1975 at the lower level of demand suggests projections of the removal of sawtimber that could be sustained by projected growth beyond 1975 if forestry continues to progress as indicated by recent trends.

The approximate balance of projected growth and needed growth in 1975 for all species combined is the result of a growth surplus of more than 8 billion board-feet for eastern hardwoods and a deficit of 6 billion board-feet for eastern softwoods and western species combined (table 292). As previously shown, trends of growth projected for the period after 1975 for lower level demands indicate that by 2000 the growth surplus of eastern hardwoods would be reduced to 3.6 billion board-feet and the growth deficits of eastern softwoods and western species combined would increase to 16.2 billion board-feet. This would leave a deficit for all species combined of more than 12 billion board-feet.

In view of these trends, the timber removal that could be sustained for each species group would be substantially different than the timber removal for each group needed to supply lower level demands. If an approximate balance between removal and growth is to be maintained after 1975 for all species combined, timber removal would need to be increased for eastern hardwoods above that indicated by lower demands and reduced for eastern softwoods and western species.

The trends assumed in timber removal were that (a) timber removal of eastern hardwoods would increase sufficiently after 1975 to be in balance with projected growth of this species group by 1985 and thereafter; (b) timber removal of eastern softwoods and western species together would be reduced sufficiently after 1975 to balance the combined growth of these species groups by 1985, and after that would increase only as the combined growth of the two species groups increased; and (c) allocations of timber removal would be greater than growth of western species and less than growth of eastern softwoods to eventually achieve necessary adjustments of inventory for each species group. These allocations were made in the same proportions as the timber removal allocations of the lower projection. The combination of these proportions and the above assumptions resulted in a timber removal of western species for 1985 that was lower than for 1975.

On the basis of these assumptions, projected growth would sustain a timber removal gradually increasing from 59 billion board-feet in 1975 to 72 billion board-feet in 2000 (table 293 and fig. 136). Achievement of this increase would be accompanied by substantial changes in both the pattern of wood use and the volume of sawtimber removal projected as necessary to meet lower level demands. These changes are summarized for the year 2000 as follows:

	Timber removal needed to supply lower level demand (billion bd.-ft.)	*Sustained timber removal (billion bd.-ft.)*	*Difference (percent)*
Softwoods [1]	57.1	47.7	−16
Eastern hardwoods	22.2	24.5	+10
Total	79.3	72.2	−9

[1] Includes a small volume of western hardwoods.

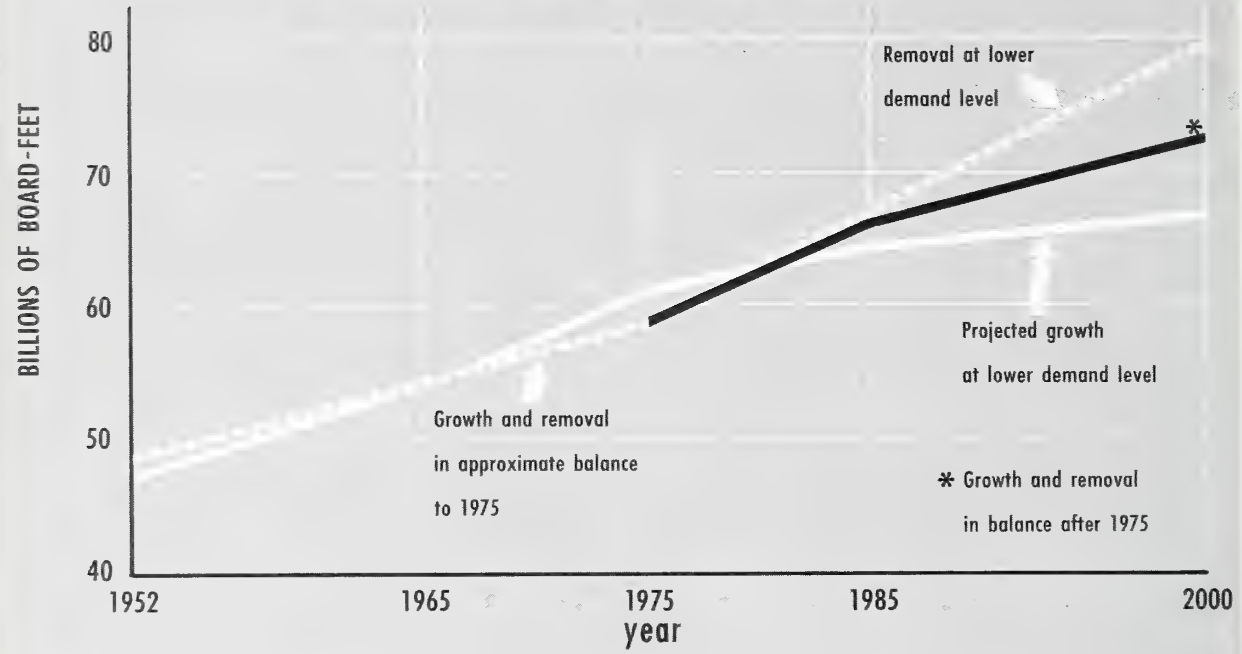
These comparisons show that the timber removal which could be sustained by the intensity of forestry expected from continuation of recent trends would be 9 percent less than that needed to meet lower level demands in 2000. Moreover, the reduced removal of softwoods and the increased removal of eastern hardwoods reflect a much larger switch from softwoods to hardwoods than was estimated as possible in lower demand projections.

Inventories Remain Unbalanced

Earlier comparisons made here between needed inventories and those of 1953 show that substantial adjustments in the inventories of the three species groups are essential if growth is to sustain projected demands to 2000. If projected demands are met and forestry progresses as indicated by recent trends, these adjustments would not occur under either level of demand.

Under medium level demands, the projected inventory of sawtimber in 1975 would be 7 percent greater than needed inventory (table 294). This surplus, based on the total inventory of all species, obscures the situation that projected inventory for eastern softwoods would be 54 percent less than needed inventory. The inventory of western species would be 66 percent larger than needed inventory, and projected and needed inventories of eastern hardwoods would be about equal.

After 1975, sharp declines in projected sawtimber inventories of all three species groups would begin as a result of the increasingly large timber removals necessary to meet medium level demands. Indications of the projections are that these declines would be sharper for eastern softwoods and eastern hardwoods than for western



Sustained timber removal as shown by the solid line above brings timber removal and projected growth of both softwoods and hardwoods into balance by 1985. The increased use of hardwoods needed to attain this balance exceeds any trends now in sight. Reduced removal of softwoods needed to reach a balance falls below the removal necessary to supply lower projected demands for softwoods. Moreover, sustained timber removal for all species combined falls below the total removal needed to supply lower projected demands.

Figure 136

TABLE 293.—*Trend of timber removal and projected growth of sawtimber, with removal and growth in approximate balance*

Item	1952	1965 [1]	1975 [2]	1985	2000
	Billion bd.-ft.	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*
Timber removal:					
Eastern hardwoods	[3] 12. 2	14. 1	15. 7	24. 5	24. 5
Eastern softwoods	[3] 14. 1	14. 9	15. 7	16. 7	19. 9
Western species	[3] 22. 5	25. 2	27. 4	24. 8	27. 8
Total	[3] 48. 8	54. 2	58. 8	66. 0	72. 2
Projected growth:					
Eastern hardwoods	[4] 19. 1	21. 2	24. 1	24. 5	24. 5
Eastern softwoods	[4] 17. 0	18. 9	20. 7	21. 3	24. 2
Western species	[4] 11. 3	14. 0	16. 3	19. 4	22. 5
Total	[4] 47. 4	54. 1	61. 1	65. 2	71. 2

[1] Timber removal and projected growth from lower level calculations not published elsewhere.
[2] Timber removal conforms with removal estimates at lower level (see table 283) and projected growth conforms with projected growth at lower level (table 291).
[3] Actual timber cut (from table 284).
[4] Net growth (from table 281).

species. The declines would be modified, as were the declines in projected growth, by rises in price accompanying the trend toward limitations in supply and a consequent reduction in timber removal.

Under lower level demand, the projected sawtimber inventory of 2,002 billion board-feet for all species in 2000 indicates no substantial change from the 1953 inventory of 2,057 billion board-feet and would be slightly larger than the needed inventory. Projected inventories of both eastern hardwoods and western species are larger than needed inventories in 1975 and 2000, but for eastern softwoods the projected inventory is about one-third less than needed inventory during the rest of the century.

TABLE 294.—*Relation of projected inventory to needed inventory 1975 and 2000, by levels of demand and species groups*

Item	Live sawtimber			Growing stock		
	Projected inventory	Needed inventory	Projected in relation to needed	Projected inventory	Needed inventory	Projected in relation to needed
Medium level demand:	*Billion bd.-ft.*	*Billion bd.-ft.*	*Percent*	*Billion cu. ft.*	*Billion cu. ft.*	*Percent*
1975:						
Eastern hardwoods	498	482	+3	230	114	+102
Eastern softwoods	292	635	−54	82	124	−34
Western species	1, 144	691	+66	261	178	+47
All species	1, 934	1, 808	+7	573	416	+38
2000:						
Eastern hardwoods	366	769	−52	289	186	+55
Eastern softwoods	(1)	970	−(2)	7	181	−96
Western species	602	1, 057	−43	203	260	−22
All species	968	2, 796	−65	499	627	−20
Lower level demand:						
1975:						
Eastern hardwoods	542	358	+51	241	104	+132
Eastern softwoods	310	449	−31	96	110	−13
Western species	1, 189	597	+99	267	158	+69
All species	2, 041	1, 404	+45	604	372	+62
2000:						
Eastern hardwoods	732	503	+46	357	152	+135
Eastern softwoods	385	598	−36	116	147	−21
Western species	885	793	+12	236	212	+11
All species	2, 002	1, 894	+6	709	511	+39

[1] Negligible.

[2] Because projected inventory is negligible, the theoretical difference would approach a minus 100 percent.

Although projected inventories of all species combined appear to be sufficiently large with respect to needed inventories, as shown below, they would not produce the growth needed to sustain demands until 2000 under assumptions of either the medium or lower levels:

	Projected inventory in relation to needed inventory (percent)	*Projected growth in relation to needed growth (percent)*
Medium level demand:		
1975	+7	−14
Lower level demand:		
1975	+45	+4
2000	+6	−16

The major reasons are that (a) because the necessary upward adjustment of the eastern softwood inventory of sawtimber would not take place, a shortage of needed growth from that source would result; (b) the young timber established on areas of western old growth harvested between 1952 and 2000 would be too young to contribute materially to growth in 2000, and the relatively small area of young timber established prior to 1952 plus the remaining area of slow-growing old growth would be inadequate to produce the needed growth of western species.

Even though projected inventories would not produce the growth needed to sustain the increas-

ing demands of either medium or lower levels until 2000, they are large enough to supply the timber removal needed to meet medium level demands through 1975 and lower level demands through 2000. However, this would be at the cost of inventory changes leading to limited supplies and increasing difficulty in reaching needed adjustments later on.

Expected Trends in Quality

Projections of the future timber supply are incomplete if confined solely to consideration of volume. Quality should also be considered, but quality is more difficult to express in concrete terms than volume. The reason is that (a) standards of quality are numerous and vary widely for the many products made of wood, and (b) basic information on quality of current inventory and growth is limited compared to information on volume. Notwithstanding, surveys in some regions and States have included quality considerations that provide a basis for general consideration of future trends.

In the Lake States and South Atlantic regions, and in Mississippi, surveys of the 1930's were followed by similar surveys in the late 1940's and early 1950's. The commercial forest land in these three areas is 116 million acres or about 31 percent of all commercial forest land in the East. In each area the proportion of sawtimber volume in the smaller tree sizes increased between surveys. This trend was contributed to by a concentration of the timber cut on the larger, better quality trees because of their higher values and lower operating costs per unit of volume output. With some exceptions, subsequent cutting has been done prior to full replacement by growth of the previous size and quality of trees. Thus, the larger and better quality trees available at the time of each subsequent cutting are smaller and of poorer quality than previously. The result is harvest of successively smaller sizes at each repeated cut.

Current inventories of both eastern softwoods and eastern hardwoods are characterized by large volumes in small trees and poorer log grades which have limitations for the production of important end products. Many of these smaller trees are free of defects and will improve in quality if trends toward cutting successively smaller sizes are modified.

Another trend affecting the quality of forest stands in some areas of both the East and the West is the natural replacement of preferred species by less useful species. Factors responsible for these trends, operating singly or in combination, are fire, insects, disease, and cutting. Although these factors sometimes affect species composition favorably, available evidence indicates a gradual trend toward reduced supplies of the preferred species.

Cull trees are a large overburden of useless material in eastern hardwood forests. Characteristically, they remain standing through successive cuttings of sound trees, and continued retention of them restricts future possibilities for both volume and quality production. In contrast, cull trees are much less prevalent in softwood stands of both the East and West.

The current inventory of western species, with 50 percent of the volume in trees 32 inches in diameter and larger, still contains much high-quality material. But trends toward smaller sizes and poorer quality are present although less pronounced than for eastern species groups.

Under medium level demand assumptions, removal of eastern softwood sawtimber would be slightly less than projected growth in 1975 but would greatly exceed projected growth later in the century (table 295). This relation between timber removal and projected growth in 2000 is a strong indication that economic factors would favor the continued cutting of successively smaller trees, which would result in further declines in quality.

Under lower level demands, timber removal of eastern softwoods would be less than projected growth in 1975 but would be slightly greater than projected growth in 2000. This comparison indicates a decline in quality but at a much slower rate than would occur under medium level demands. With timber removal substantially less than projected growth in 1975, some temporary halt in declining quality trends might occur. Any temporary change, however, would not likely add substantial supplies of quality timber, because

TABLE 295.—*Timber removal and projected growth of sawtimber in 1975 and 2000, by levels of demand and species groups*

Demand level and species group	1975		2000	
	Timber removal	Projected growth	Timber removal	Projected growth
	Billion bd.-ft.	*Billion bd.-ft.*	*Billion bd.-ft.*	*Billion bd.-ft.*
Medium level:				
Eastern hardwoods	18. 4	22. 6	29. 4	12. 2
Eastern softwoods	18. 1	20. 1	33. 2	(1)
Western species	31. 7	15. 9	42. 8	13. 0
All species	68. 2	58. 6	105. 4	25. 2
Lower level:				
Eastern hardwoods	15. 7	24. 1	22. 2	25. 6
Eastern softwoods	15. 7	20. 7	24. 9	23. 0
Western species	27. 4	16. 3	32. 2	18. 1
All species	58. 8	61. 1	79. 3	66. 7

[1] Negligible.

of the poor quality of the eastern softwood inventory in 1952.

Although supplies of large timber in the inventory of western species will help meet quality demands for some years, timber removal exceeds projected growth under both medium and lower demand levels for the rest of the country. This implies acceleration of the trend toward cutting smaller and poorer quality trees, with consequent declines in the supply of high-quality timber.

For eastern hardwood sawtimber, projected growth exceeds timber removal in both 1975 and 2000 under lower level demand assumptions. This situation favors development of larger trees and improved quality. However, the poor quality of the current inventory would limit the supply of high-quality timber that could be accumulated by the end of the century. Under medium level demands, declining trends in quality of eastern hardwood sawtimber are indicated by the relation between timber removal and projected growth.

Past trends toward smaller trees, the low quality of eastern inventories, and the relations between projected timber removal and growth indicate that quality of timber will continue to decline if projected demands are met at either level and if forestry progresses no faster than indicated by recent trends. Although advancing technology will help to adapt low-quality trees and logs to end uses previously supplied by higher quality material, the extent to which such advances will meet potential demands is uncertain. The outlook is for limited supplies of high-quality timber unless accelerated trends toward more intensive forestry develop soon and include emphasis on quality aspects as well as the volume of future growth.

THE TIMBER OUTLOOK

There has been much progress in forestry in recent years. Growth of sawtimber increased 9 percent between 1944 and 1952. The impact of forest fires on the timber resource has been greatly reduced, the annual rate of planting has more than doubled, and there are other indications of progress. The most significant result of this survey, however, is that the intensity of forestry expected from continuation of recent trends will not produce sufficient growth to sustain to the end of the century any one of the three projections of demand.

If medium projected demands were met over the next two decades, important impacts on the timber resource would occur before the end of the century. Inventories and growth would decline sharply, timber cut would fall well below the level needed to supply projected demands, and there would be limitations in supply of important species and grades of timber. These impacts would be felt first and to the greatest degree in eastern softwoods, but eastern hardwoods would also be involved. The overall effects would be: (1) Rising rather than stable prices for industrial wood compared with prices of competing materials; (2) declining rather than increasing per capita consumption; and (3) industrial timber products losing ground in the national economy rather than maintaining their present position.

Similar impacts would result from meeting either upper or lower projected demands, but there would be differences in the time at which they appeared. If upper demands were met, impacts would appear sooner than under medium level demands, while under lower level demands they would be delayed. By 2000, however, growth of eastern softwoods would be well below the growth needed to sustain projected demands even for the lower level.

Although meeting projected demands would result in significant impacts on timber resources by the end of the century, there is no danger of a general timber famine. One of the important indications is the 48-percent increase in timber removal between 1952 and 2000 which could be sustained by projected growth. Nevertheless, this removal reflects an increase in use of hardwoods and a reduction in use of softwoods much greater than anticipated as possible in demand projections.

The total sustained removal, all species combined, is 9 percent short of the removal needed to supply lower projected demands in 2000. Sustained removal therefore indicates scarcity but not an acute, widespread shortage. Other indications that a famine is not in prospect are the size of the current inventory in relation to needed timber removal and the great untapped growth capacity of 489 million acres of commercial forest land.

The intensity of forestry needed to sustain lower projected demands would include stepping up sawtimber growth of all species combined from the 1952 net growth of 47.4 billion board-feet to 79.3 billion board-feet in 2000, an increase of nearly 70 percent. Continuation of recent forestry trends, however, would result in a projected growth of 66.7 billion board-feet, 16 percent less than the growth needed to sustain lower level demands. Because of a substantial growth surplus of eastern hardwoods, this relatively small difference between needed and projected growth of all species groups combined obscures the larger growth increases needed for softwoods.

For both eastern softwoods and western species, projected growth would be about 30 percent less than the growth needed to sustain lower level demands. The needed additions to projected growth of softwoods could be reduced by using part of the surplus projected growth of eastern hardwoods in place of softwoods. Such substitution would mean acceleration of utilization trends beyond the rate anticipated in projections

of lower level demands. The most probable solution to achievement of lower level demands by 2000 would be an increase in projected growth somewhat below needed growth for eastern softwoods and western species coupled with accelerated substitution of hardwoods for softwoods.

Even if the growth needed to sustain lower projected demands were achieved, per capita consumption would decline. For example, one of the fundamental assumptions was that population would increase from 157 million people in 1952 to 275 million people in 2000. The volume of industrial wood needed to supply lower projected demands in 2000 is 17.41 billion cubic feet as compared to 1952 consumption of 10.27 billion cubic feet. Thus, per capita consumption of industrial wood at the lower demand level would decline from 65.4 cubic feet in 1952 to 63.3 cubic feet in 2000. The decline in per capita consumption of lumber would be from 264 board-feet in 1952 to 199 board-feet in 2000. Not only would per capita consumption of all industrial products decline but prices would rise faster than prices of competing materials.

In contrast to the lower level, achievement of medium level demands presents a tremendous task. If medium level demands were met through 1975, the growth expected from no more than continuation of recent trends in forestry would begin to drop sharply prior to 2000. To meet and sustain these demands would mean an intensity of forestry sufficient to raise sawtimber growth from the 1952 net growth of 47.4 billion board-feet to 105.4 billion board-feet in 2000, an increase of 122 percent. By species groups, the growth increases needed between 1952 and 2000 would be 52 percent for eastern hardwoods, 154 percent for eastern softwoods, and 194 percent for western species.

Attainment of this increased growth would permit per capita consumption of all industrial wood to rise from 65.4 cubic feet in 1952 to 80.0 cubic feet in 2000. Per capita consumption of lumber would increase from 264 board-feet in 1952 to 287 board-feet in 2000, and prices for industrial products would be generally parallel to prices of competing materials.

Past trends toward increasing proportions of small trees in inventories, the low quality of current inventories in the East, and projections of timber removal in excess of projected growth for eastern softwoods and western species toward the end of the century all indicate that further declines in quality are in prospect. Advances in technology will help to maintain the quality of end products. But with anticipated trends leading toward limited rather than adequate supplies of high-quality timber, uncertainty surrounds the extent to which potential demands for high-quality products can be met.

Time is a vital element affecting the timber outlook, and growth increases resulting from intensive forestry are long delayed. Increases in quality require longer periods to achieve than do increases in volume. If demands under either level are to be met and sustained near the end of the century, the trends toward intensive forestry indicated by recent developments must be greatly accelerated during the next two decades.

Appendix

Basic Statistics

BASIC STATISTICS

George F. Burks

Of the 81 tables presented here, the first 19 give detailed statistics for individual States. The others contain basic statistics for regions and sections. In addition, various summaries of these are included in appropriate sections of the report. Tables presenting statistics on ownership have not been brought together in one group but are in order according to subject matter, such as area, volume, protection, planting, and productivity of cutover lands. For reliability of statistics, see section on Adequacy of Data, p. 649.

STATE TABLES

State Tables—Continued

Protection and losses

Planting

Sectional and Regional Tables

Area

Volume

Sectional and Regional Tables—Continued

Volume—Continued

Growth

Utilization

SECTIONAL AND REGIONAL TABLES—Continued

Utilization—Continued

Comparison of growth and timber cut

Protection and losses

Sectional and Regional Tables—Continued

Protection and losses—Continued

Productivity of cutover lands

Sectional and Regional Tables—Continued

Productivity of cutover lands—Continued

Projected demand

TABLE 1.—*Land area of the United States and Coastal Alaska, by major classes of land and section, region, and State, January 1, 1953* [1]

Section, region, and State	Total land area [2]	Forest land: Total	Forest land: Commercial	Forest land: Noncommercial: Total	Noncommercial: Productive but reserved	Noncommercial: Unproductive [3]: Total	Unproductive: Reserved	Unproductive: Unreserved	Cropland in farms [4]	Pasture and range [5]: Total	Pasture and range: In farms	Pasture and range: Not in farms	Other [6]
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
North:													
New England:													
Connecticut	3,135	1,990	1,973	17	11	6		6	369	286	286		490
Maine	19,866	17,088	16,601	487	164	323	23	300	1,186	494	494		1,098
Massachusetts	5,035	3,288	3,259	29	18	11		11	473	296	296		978
New Hampshire	5,771	4,848	4,682	166	25	141	62	79	349	250	250		324
Rhode Island	677	434	430	4	4				55	38	38		150
Vermont	5,938	3,730	3,713	17	10	7		7	937	971	971		300
Total	40,422	31,378	30,658	720	232	488	85	403	3,369	2,335	2,335		3,340
Middle Atlantic:													
Delaware	1,266	454	448	6		6		6	463	100	100		249
Maryland	[7] 6,363	2,920	2,897	23	20	3		3	1,838	798	798		[7] 807
New Jersey	4,814	1,958	1,910	48	17	31		31	930	286	286		1,640
New York	30,684	14,450	12,002	2,448	2,377	71		71	6,906	4,705	4,705		4,623
Pennsylvania	28,829	15,205	15,108	97	97				6,834	2,922	2,922		3,868
West Virginia	15,411	9,907	9,860	47	41	6		6	1,567	3,113	3,113		824
Total	87,367	44,894	42,225	2,669	2,552	117		117	18,538	11,924	11,924		12,011
Lake States:													
Michigan	36,494	19,322	18,849	473	272	201	5	196	9,061	3,084	3,084		5,027
Minnesota	51,206	19,344	18,098	1,246	428	818	7	811	20,901	4,178	4,178		6,783
Wisconsin	35,011	16,535	16,325	210	18	192	20	172	10,718	4,619	4,619		3,139
Total	122,711	55,201	53,272	1,929	718	1,211	32	1,179	40,680	11,881	11,881		14,949
Central:													
Illinois	35,798	3,993	3,938	55	46	9		9	21,351	4,856	4,856		5,598
Indiana	23,171	4,103	4,045	58	58				11,777	3,518	3,518		3,773
Iowa	35,869	2,510	2,505	5	5				22,905	6,875	6,875		3,579
Kentucky	25,513	11,497	11,446	51	51				6,336	6,961	6,961		719
Missouri	44,305	15,177	15,064	113	37	76		76	13,651	11,506	11,140	366	3,971
Ohio	26,240	5,446	5,396	50	50				11,330	5,111	5,111		4,353
Total	190,896	42,726	42,394	332	247	85		85	87,350	38,827	38,461	366	21,993
Plains:													
Kansas	52,549	1,668	1,664	4	4				27,919	22,362	17,784	4,578	600
Nebraska	49,064	1,482	1,480	2	2				22,377	24,605	22,815	1,790	600
North Dakota	44,836	433	414	19	3	16		16	26,693	11,670	10,525	1,145	6,040
Oklahoma (West)	34,382	4,302	650	3,652	10	3,642		3,642	12,428	14,233	13,234	999	3,419
South Dakota (East)	42,364	776	684	92	3	89		89	19,004	22,184	12,700	9,484	400
Texas (West)	150,005	26,000	600	25,400	4	25,396	41	25,355	29,405	83,173	75,173	8,000	11,427
Total	373,200	34,661	5,492	29,169	26	29,143	41	29,102	137,826	178,227	152,231	25,996	22,486
Total, North	814,596	208,860	174,041	34,819	3,775	31,044	158	30,886	287,763	243,194	216,832	26,362	74,779
South:													
South Atlantic:													
North Carolina	31,422	19,513	18,976	537	335	202	18	184	6,966	1,790	1,790		3,153
South Carolina	19,395	11,943	11,891	52	49	3		3	4,892	984	984		1,576
Virginia	25,532	15,832	15,285	547	284	263	21	242	4,225	3,943	3,943		1,532
Total	76,349	47,288	46,152	1,136	668	468	39	429	16,083	6,717	6,717		6,261
Southeast:													
Alabama	32,690	20,771	20,756	15	5	10		10	7,123	3,305	3,305		1,491
Florida	34,728	23,047	21,519	1,528	74	1,454	186	1,268	2,388	4,863	4,332	531	4,430
Georgia	37,429	24,057	23,969	88	18	70		70	9,214	2,458	2,458		1,700
Mississippi	30,239	16,473	16,440	33	33				7,368	3,884	3,884		2,514
Tennessee	26,750	12,558	12,301	257	257				7,064	4,513	4,513		2,615
Total	161,836	96,906	94,985	1,921	387	1,534	186	1,348	33,157	19,023	18,492	531	12,750
West Gulf:													
Arkansas	33,712	19,346	19,292	54	51	3		3	7,182	4,057	4,057		3,127
Louisiana	28,904	15,990	15,899	91	84	7		7	3,854	3,956	2,956	1,000	5,104
Oklahoma (East)	9,798	6,027	5,257	770	20	750	10	740	1,270	1,828	1,828		673
Texas (East)	18,643	11,708	11,703	5	5				1,923	3,787	3,787		1,225
Total	91,057	53,071	52,151	920	160	760	10	750	14,229	13,628	12,628	1,000	10,129
Total, South	329,242	197,265	193,288	3,977	1,215	2,762	235	2,527	63,469	39,368	37,837	1,531	29,140

See footnotes at end of table.

TABLE 1.—*Land area of the United States and Coastal Alaska, by major classes of land and section, region, and State, January 1, 1953* [1]—Continued

Section, region, and State	Total land area [2]	Forest land							Cropland in farms [4]	Pasture and range [5]			Other [6]
		Total	Commercial	Noncommercial						Total	In farms	Not in farms	
				Total	Productive but reserved	Unproductive [3]							
						Total	Reserved	Unreserved					
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
West:													
Pacific Northwest:													
Douglas-fir subregion	35. 100	29, 047	25, 455	3, 592	1, 551	2, 041	827	1, 214	2, 007	1, 581	1, 521	60	2, 465
Pine subregion	69, 284	25, 082	19, 910	5, 172	688	4, 484	556	3, 928	9, 567	33. 547	15, 634	17, 913	1, 088
Total	104, 384	54, 129	45, 365	8, 764	2. 239	6, 525	1, 383	5, 142	11, 574	35, 128	17, 155	17. 973	3, 553
Oregon	61, 641	30, 261	25. 875	4, 386	960	3, 426	370	3, 056	4. 568	25, 372	10, 634	14, 738	1, 440
Washington	42, 743	23, 868	19, 490	4, 378	1, 279	3, 099	1, 013	2, 086	7, 006	9, 756	6, 521	3. 235	2, 113
Total	104, 384	54, 129	45, 365	8, 764	2, 239	6, 525	1, 383	5, 142	11. 574	35, 128	17, 155	17, 973	3, 553
California	100. 314	42, 541	17, 317	25, 224	1, 202	24, 022	1, 941	22, 081	10, 235	26, 300	17, 074	9, 226	21, 238
Northern Rocky Mountain:													
Idaho	52, 972	21, 025	13, 372	7, 653	1, 475	6, 178	2, 140	4, 038	4, 745	22, 659	6, 111	16, 548	4, 543
Montana	93, 362	22, 330	15, 727	6, 603	1, 070	5, 533	1, 457	4, 076	12, 657	56, 324	42, 498	13, 826	2, 051
South Dakota (West)	6. 619	1, 393	1, 266	127	15	112	18	94	818	4, 321	3, 321	1, 000	87
Wyoming	62, 404	10, 513	3, 475	7, 038	1, 958	5, 080	835	4, 245	2, 712	48, 234	27, 513	20. 721	945
Total	215, 357	55, 261	33, 840	21, 421	4, 518	16, 903	4, 450	12, 453	20, 932	131, 538	79, 443	52, 095	7, 626
Southern Rocky Mountain:													
Arizona	72, 688	19, 212	3, 180	16, 032	223	15, 809	577	15, 232	1, 082	47, 469	31. 297	16, 172	4, 925
Colorado	66. 510	20, 834	8, 451	12, 383	544	11, 839	767	11, 072	11, 028	32. 757	20, 633	12, 124	1, 891
Nevada	70, 265	12, 036	109	11, 927	27	11, 900	500	11, 400	619	55, 492	6, 217	49, 275	2, 118
New Mexico	77. 767	21, 329	5, 735	15. 594	617	14. 977	343	14, 634	2, 393	50, 929	36, 697	14, 232	3, 116
Utah	52, 701	16, 219	3, 014	13, 205	201	13, 004	609	12, 395	2, 053	31, 071	6, 815	24, 256	3, 358
Total	339, 931	89, 630	20, 489	69, 141	1, 612	67, 529	2, 796	64, 733	17, 175	217, 718	101, 659	116, 059	15, 408
Total, West	759, 986	241, 561	117, 011	124, 550	9, 571	114, 979	10, 570	104, 409	59, 916	410, 684	215, 331	195, 353	47, 825
United States	1, 903, 824	647, 686	484, 340	163, 346	14, 561	148, 785	10, 963	137, 822	411, 148	693, 246	470, 000	223, 246	151, 744
Coastal Alaska	35, 519	16, 508	4, 269	12, 239	183	12, 056	701	11, 355	3	91	81	10	18. 917
All regions	1, 939, 343	664, 194	488. 609	175, 585	14, 744	160. 841	11, 664	149, 177	411, 151	693. 337	470. 081	223. 256	170, 661

[1] Similar in format to table 1 of Basic Forest Statistics for the United States, Jan. 1945 (revised 1950 issue), but the data are not directly comparable because of changes in standards between 1945 and 1952.
[2] Source: 1950 Bureau of the Census.
[3] Lands currently unproductive for timber, but includes land that may be currently productive for the management of grazing, watershed, recreation, or wildlife resources.
[4] Source: 1950 Census of Agriculture.
[5] Exclusive of that in forest land.
[6] Farmsteads, roads, powerlines, urban, etc.
[7] Includes District of Columbia, 39 thousand acres.

TABLE 2.—*Commercial forest land area in the United States and Coastal Alaska, by stand-size class and section, region, and State, January 1, 1953* [1]

Section, region, and State	Total		Sawtimber stands			Pole-timber stands	Seedling and sapling stands	Nonstocked and other areas
			Total	Old-growth [2]	Young growth			
	Thousand acres	*Percent*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
North:								
New England:								
Connecticut	1, 973	0. 40	334	----------	334	1, 065	529	45
Maine	16, 601	3. 40	5, 869	----------	5, 869	8, 494	1, 811	427
Massachusetts	3, 259	. 67	395	----------	395	1, 557	1, 271	36
New Hampshire	4, 682	. 96	1, 916	----------	1, 916	1, 736	849	181
Rhode Island	430	. 09	14	----------	14	234	169	13
Vermont	3, 713	. 76	1, 774	----------	1, 774	1, 415	340	184
Total	30, 658	6. 28	10, 302	----------	10, 302	14, 501	4, 969	886
Middle Atlantic:								
Delaware	448	. 09	242	----------	242	134	60	12
Maryland	2, 897	. 59	1, 416	----------	1, 416	896	451	134
New Jersey	1, 910	. 39	174	----------	174	906	733	97
New York	12, 002	2. 46	5, 029	----------	5, 029	4, 276	2, 406	291
Pennsylvania	15, 108	3. 09	3, 279	----------	3, 279	7, 481	3, 730	618
West Virginia	9, 860	2. 02	4, 862	----------	4, 862	3, 298	1, 462	238
Total	42, 225	8. 64	15, 002	----------	15, 002	16, 991	8, 842	1, 390
Lake States:								
Michigan	18, 849	3. 86	2, 556	----------	2, 556	5, 411	7, 668	3, 214
Minnesota	18, 098	3. 70	2, 017	----------	2, 017	5, 281	6, 317	4, 483
Wisconsin	16. 325	3. 34	1, 884	----------	1, 884	5. 318	6. 385	2, 738
Total	53, 272	10. 90	6, 457	----------	6, 457	16, 010	20, 370	10, 435

See footnotes at end of table.

TABLE 2.—*Commercial forest land area in the United States and Coastal Alaska, by stand-size class and section, region, and State, January 1, 1953* [1]—Continued

Section, region, and State	Total		Sawtimber stands			Pole-timber stands	Seedling and sapling stands	Nonstocked and other areas
			Total	Old-growth [2]	Young growth			
North—Continued	*Thousand acres*	*Percent*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Central:								
Illinois	3,938	0.81	1,823		1,823	981	729	405
Indiana	4,045	.83	2,084		2,084	1,337	600	24
Iowa	2,505	.51	903		903	909	341	352
Kentucky	11,446	2.34	4,964		4,964	4,040	1,830	612
Missouri	15,064	3.08	2,033		2,033	6,477	4,778	1,776
Ohio	5,396	1.11	2,679		2,679	1,978	679	60
Total	42,394	8.68	14,486		14,486	15,722	8,957	3,229
Plains:								
Kansas	1,664	.35	632		632	680	188	164
Nebraska	1,480	.30	309		309	453	442	276
North Dakota	414	.08	96		96	127	153	38
Oklahoma (West)	650	.13	160		160	410	70	10
South Dakota (East)	684	.14	148	25	123	229	130	177
Texas (West)	600	.12	130		130	390	70	10
Total	5,492	1.12	1,475	25	1,450	2,289	1,053	675
Total, North	174,041	35.62	47,722	25	47,697	65,513	44,191	16,615
South:								
South Atlantic:								
North Carolina	18,976	3.89	6,337		6,337	7,141	4,826	672
South Carolina	11,891	2.43	4,999		4,999	3,065	3,092	735
Virginia	15,285	3.13	5,497		5,497	8,006	1,713	69
Total	46,152	9.45	16,833		16,833	18,212	9,631	1,476
Southeast:								
Alabama	20,756	4.25	6,091		6,091	10,912	3,503	250
Florida	21,519	4.40	3,223		3,223	3,541	5,603	9,152
Georgia	23,969	4.91	6,355		6,355	8,814	7,200	1,600
Mississippi	16,440	3.36	5,920		5,920	6,380	3,117	1,023
Tennessee	12,301	2.52	2,916		2,916	7,554	1,674	157
Total	94,985	19.44	24,505		24,505	37,201	21,097	12,182
West Gulf:								
Arkansas	19,292	3.95	6,604		6,604	9,364	3,043	281
Louisiana	15,899	3.25	7,176		7,176	4,814	2,120	1,789
Oklahoma (East)	5,257	1.07	1,304		1,304	2,774	1,098	81
Texas (East)	11,703	2.40	4,080		4,080	6,011	1,349	263
Total	52,151	10.67	19,164		19,164	22,963	7,610	2,414
Total, South	193,288	39.56	60,502		60,502	78,376	38,338	16,072
West:								
Pacific Northwest:								
Douglas-fir subregion	25,455	5.21	14,611	7,468	7,143	4,542	4,260	2,042
Pine subregion	19,910	4.07	14,065	9,910	4,155	3,968	1,227	650
Total	45,365	9.28	28,676	17,378	11,298	8,510	5,487	2,692
Oregon	25,875	5.30	17,954	11,581	6,373	3,946	2,534	1,441
Washington	19,490	3.98	10,722	5,797	4,925	4,564	2,953	1,251
Total	45,365	9.28	28,676	17,378	11,298	8,510	5,487	2,692
California	17,317	3.54	14,038	11,240	2,798	1,122	44	2,113
Northern Rocky Mountain:								
Idaho	13,372	2.74	6,922	3,695	3,227	3,610	1,453	1,387
Montana	15,727	3.22	5,683	3,943	1,740	6,330	2,402	1,312
South Dakota (West)	1,266	.26	655	174	481	297	253	61
Wyoming	3,475	.71	1,779	1,361	418	1,038	602	56
Total	33,840	6.93	15,039	9,173	5,866	11,275	4,710	2,816
Southern Rocky Mountain:								
Arizona	3,180	.65	2,855	1,787	1,068	200	60	65
Colorado	8,451	1.74	3,827	2,762	1,065	2,285	1,544	795
Nevada	109	.02	79	41	38	26	1	3
New Mexico	5,735	1.17	3,899	2,183	1,716	1,224	188	424
Utah	3,014	.62	1,979	1,466	513	877	146	12
Total	20,489	4.20	12,639	8,239	4,400	4,612	1,939	1,299
Total, West	117,011	23.95	70,392	46,030	24,362	25,519	12,180	8,920
United States	484,340	99.13	178,616	46,055	132,561	169,408	94,709	41,607
Coastal Alaska	4,269	.87	4,092	3,954	138	75	75	27
All regions	488,609	100.00	182,708	50,009	132,699	169,483	94,784	41,634

[1] Similar in format to table 2 of Basic Forest Statistics for the United States, January 1945 (revised 1950 issue), but the data are not directly comparable because of changes in standards between 1945 and 1952.

[2] There is still some old-growth sawtimber in the East, but it is scattered and its area is relatively small. For this reason, none of the East's sawtimber area has been classified as old-growth except a small area of ponderosa pine in eastern South Dakota. Elsewhere in the East, the area is included with young-growth sawtimber.

TABLE 3.—*Commercial forest land area in the United States and Coastal Alaska, by ownership class and section, region, and State, January 1, 1953* [1]

Section, region, and State	All ownerships	Federal ownership or trusteeship					State [2]	County and municipal [2]	Private			
		Total	National forest	Indian [2]	Bureau of Land Management [2]	Other [2]			Total	Farm	Forest industries [3]	Other
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
North:												
New England:												
Connecticut	1,973	1				1	122	32	1,818	526	3	1,289
Maine	16,601	90	51			39	41	51	16,419	2,232	6,617	7,570
Massachusetts	3,259	29				29	280	90	2,860	740	259	1,861
New Hampshire	4,682	585	580			5	45	52	4,000	1,039	771	2,190
Rhode Island	430	(4)				(4)	13	13	404	79		325
Vermont	3,713	199	191			8	79	19	3,416	1,522	528	1,366
Total	30,658	904	822			82	580	257	28,917	6,138	8,178	14,601
Middle Atlantic:												
Delaware	448	1				1	10	2	435	217	124	94
Maryland	2,897	54	4			50	128	32	2,683	1,169	57	1,457
New Jersey	1,910	1				1	130	50	1,729	320	(5)	1,409
New York	12,002	98				98	714	83	11,107	3,473	1,172	6,462
Pennsylvania	15,108	492	454			38	2,580	157	11,879	3,424	442	8,013
West Virginia	9,860	895	881			14	83	4	8,878	3,197	270	5,411
Total	42,225	1,541	1,339			202	3,645	328	36,711	11,800	2,069	22,842
Lake States:												
Michigan	18,849	2,482	2,343	23	13	103	3,819	86	12,462	3,877	1,447	7,138
Minnesota	18,098	3,055	2,195	717	49	94	3,484	3,619	7,940	4,881	578	2,481
Wisconsin	16,325	2,003	1,357	379	5	262	444	2,447	11,431	6,426	1,014	3,991
Total	53,272	7,540	5,895	1,119	67	459	7,747	6,152	31,833	15,184	3,039	13,610
Central:												
Illinois	3,938	216	184			32	10	(4)	3,712	3,050	10	652
Indiana	4,045	172	112			60	109	2	3,762	2,878	9	875
Iowa	2,505	23	3	1		19	13	6	2,463	2,321		142
Kentucky	11,446	672	455			217	53	(4)	10,721	4,903	308	5,510
Missouri	15,064	1,461	1,339		1	121	156	(4)	13,447	8,498	460	4,489
Ohio	5,396	88	88			(4)	168	41	5,099	3,047	30	2,022
Total	42,394	2,632	2,181	1	1	449	509	49	39,204	24,697	817	13,690
Plains:												
Kansas	1,664	1				1			1,663	1,160		503
Nebraska	1,480	37	30	7			24	(4)	1,419	820		599
North Dakota	414	149		91	1	57	10		255	182		73
Oklahoma (West)	650						10		640	540		100
South Dakota (East)	684	290	15	270	3	2	21		373	373		
Texas (West)	600								600	500		100
Total	5,492	477	45	[6] 368	4	60	65	(4)	4,950	3,575		1,375
Total, North	174,041	13,094	10,282	1,488	72	1,252	12,546	6,786	141.615	61,394	14,103	66,118
South:												
South Atlantic:												
North Carolina	18,976	1,304	999	47		258	236	43	17,393	13,590	2,584	1,219
South Carolina	11,891	763	524			239	128	25	10,975	7,530	1,696	1,749
Virginia	15,285	1,417	1,260			157	86	14	13,768	8,848	1,334	3,586
Total	46,152	3,484	2,783	47		654	450	82	42,136	29,968	5,614	6,554
Southeast:												
Alabama	20,756	789	614		10	165	150	27	19,790	8,114	3,138	8,538
Florida	21,519	1,813	1,035	36	14	728	382	56	19,268	8,905	4,369	5,994
Georgia	23,969	1,557	641			916	102	23	22,287	15,854	4,246	2,187
Mississippi	16,440	1,245	1,036	10	4	195	54	419	14,722	6,958	2,602	5,162
Tennessee	12,301	833	566			267	329	10	11,129	6,126	1,088	3,915
Total	94,985	6,237	3,892	46	28	2,271	1,017	535	87,196	45,957	15,443	25,796
West Gulf:												
Arkansas	19,292	2,802	2,326		122	354	106	2	16,382	6,733	4,118	5,531
Louisiana	15,899	667	536		4	127	176	5	15,051	3,160	4,281	7,610
Oklahoma (East)	5,257	270	180	20	(4)	70	79	(4)	4,908	1,700	944	2,264
Texas (East)	11,703	736	655	4		77	29	2	10,936	2,625	3,123	5,188
Total	52,151	4,475	3,697	24	126	628	390	9	47,277	14,218	12,466	20,593
Total, South	193,288	14,196	10,372	117	154	3,553	1,857	626	176,609	90.143	33,523	52,943

See footnotes at end of table.

TABLE 3.—*Commercial forest land area in the United States and Coastal Alaska, by ownership class and section, region, and State, January 1, 1953* [1]—Continued

Section, region, and State	All ownerships	Federal ownership or trusteeship					State [2]	County and municipal [2]	Private			
		Total	National forest	Indian [2]	Bureau of Land Management [2]	Other [2]			Total	Farm	Forest industries [3]	Other
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
West:												
Pacific Northwest:												
Douglas-fir subregion	25, 455	9, 707	7, 139	257	2, 256	55	1, 971	452	13, 325	3, 001	6, 954	3, 370
Pine subregion	19, 910	12, 943	9, 970	2, 506	404	63	665	53	6, 249	2, 343	1, 926	1, 980
Total	45, 365	22, 650	17, 109	2, 763	2, 660	118	2, 636	505	19, 574	5, 344	8, 880	5, 350
Oregon	25, 875	15, 067	11, 435	1, 148	2, 481	3	758	282	9, 768	3, 458	4, 733	1, 577
Washington	19, 490	7, 583	5, 674	1, 615	179	115	1, 878	223	9, 806	1, 886	4, 147	3, 773
Total	45, 365	22, 650	17, 109	2, 763	2, 660	118	2, 636	505	19, 574	5, 344	8, 880	5, 350
California	17, 317	9, 070	8, 573	133	324	40	186	8	8, 053	1, 586	3, 389	3, 078
Northern Rocky Mountain:												
Idaho	13, 372	9, 579	9, 174	74	331	-------	826	(4)	2, 967	1, 166	1, 180	621
Montana	15, 727	10, 187	8, 939	602	577	69	608	75	4, 857	2, 360	1, 086	1, 411
South Dakota (West)	1, 266	980	972	-------	6	2	61	2	223	150	6	67
Wyoming	3, 475	2, 992	2, 542	146	292	12	69	2	412	325	(5)	87
Total	33, 840	23, 738	21, 627	822	1, 206	83	1, 564	79	8, 459	4, 001	2, 331	2, 127
Southern Rocky Mountain:												
Arizona	3, 180	3, 021	2, 201	815	5	-------	34	-------	125	46	(5)	79
Colorado	8, 451	6, 668	6, 262	26	368	12	132	38	1, 613	994	-------	619
Nevada	109	32	30	-------	2	-------	-------	-------	77	11	(5)	66
New Mexico	5, 735	3, 839	2, 993	712	90	44	158	5	1, 733	1, 355	136	242
Utah	3, 014	2, 566	1, 865	69	632	-------	56	-------	392	343	(5)	49
Total	20, 489	16, 126	13, 351	1, 622	1, 097	56	380	43	3, 940	2, 749	156	1, 035
Total, West	117, 011	71, 584	60, 660	5, 340	5, 287	297	4, 766	635	40, 026	13, 680	14, 756	11, 590
United States	484, 340	98, 874	81, 314	6, 945	5, 513	5, 102	19, 169	8, 047	358, 250	165, 217	62, 382	130, 651
Coastal Alaska	4, 269	4, 250	3, 445	20	785	-------	-------	-------	19	-------	-------	19
All regions	488, 609	103, 124	84, 759	6, 965	6, 298	5, 102	19, 169	8, 047	358, 269	165, 217	62, 382	130, 670

[1] Similar in format to table 5 of Basic Forest Statistics for the United States, January 1945 (revised 1950 issue), but the data are not directly comparable because of changes in standards between 1945 and 1952.

[2] Because of different definitions of commercial forest land adopted by the Forest Service and other public agencies, acreage figures for these ownerships may vary from actual published commercial forest land acreages of the public agencies concerned.

[3] Includes lumber, pulp, and other wood-manufacturing industries.

[4] Less than 0.5 thousand acres.

[5] Included with "Other private" to avoid possible disclosure of commercial forest land area owned by individual wood-using industries in particular States. In regions where these combinations have been made, State figures for wood-using industries and "Other private" do not add to regional totals that give the proper ownership distribution on a regional basis. Sectional and national totals also show correct ownership distribution. In all other cases State figures are in agreement with regional totals.

[6] Included is an undetermined amount of commercial forest land occurring on a total area of 333,040 acres which had been transferred, or was in the process of being transferred, to "other" Federal ownership for conversion to reservoir use.

TABLE 4.—*Commercial forest land area in private ownership in the United States and Coastal Alaska and number of private owners, by size class of owner and State, 1953* [1]

State	All classes		Under 100 acres		100 to 500 acres		500 to 5,000 acres		5,000 to 50,000 acres		50,000 acres and larger	
	Area	Owners	Area	Owners [2]	Area	Owners	Area	Owners	Area	Owners	Area	Owners
	Thousand acres	*Number*	*Thousand acres*	*Number*	*Thousand acres*	*Number*	*Thousand acres*	*Number*	*Thousand acres*	*Number*	*Thousand acres*	*Number*
Alabama	19, 790	169, 821	5, 504	132, 203	6, 169	34, 872	2, 928	2, 508	2, 639	218	2, 550	20
Arizona	125	458	13	331	21	106	91	21	-------	-------	(3)	(3)
Arkansas	16, 382	160, 957	4, 457	124, 300	4, 714	32, 830	2, 671	3, 720	1, 427	93	3, 113	14
California	8, 053	10, 464	301	5, 337	1, 022	3, 971	1, 293	999	2, 297	141	3, 140	16
Colorado	1, 613	4, 333	156	1, 677	441	1, 925	661	722	355	9	(4)	(4)
Connecticut	1, 818	45, 719	986	40, 614	717	5, 063	68	38	47	4	-------	-------
Delaware	435	7, 576	185	6, 379	219	1, 171	31	26	(3)	(3)	-------	-------
Florida	19, 268	93, 583	2, 103	67, 195	3, 619	21, 344	3, 840	4, 743	3, 841	270	5, 865	31
Georgia	22, 287	196, 665	5, 047	145, 760	7, 512	47, 136	4, 675	3, 552	2, 578	204	2, 475	13
Idaho	2, 967	10, 831	288	5, 489	774	4, 838	720	479	346	20	839	5
Illinois	3, 712	131, 101	2, 684	126, 397	991	4, 646	37	58	-------	-------	-------	-------
Indiana	3, 762	126, 190	3, 219	123, 118	485	3, 047	15	20	43	5	-------	-------
Iowa	2, 463	34, 738	2, 060	33, 749	403	989	-------	-------	-------	-------	-------	-------
Kansas	1, 663	57, 514	1, 473	56, 654	190	860	-------	-------	-------	-------	-------	-------
Kentucky	10, 721	243, 488	5, 249	214, 687	3, 312	25, 805	1, 616	2, 954	544	42	(4)	(4)
Louisiana	15, 051	111, 654	2, 987	91, 979	3, 260	17, 914	1, 923	1, 583	2, 665	145	4, 216	33
Maine	16, 419	77, 479	3, 134	62, 557	2, 120	14, 265	586	528	1, 480	101	9, 099	28
Maryland	2, 683	39, 544	1, 271	33, 544	1, 229	5, 829	110	164	73	7	-------	-------

See footnotes at end of table.

TABLE 4.—*Commercial forest land area in private ownership in the United States and Coastal Alaska and number of private owners, by size class of owner and State, 1953* [1]—Continued

State	All classes		Under 100 acres		100 to 500 acres		500 to 5,000 acres		5,000 to 50,000 acres		50,000 acres and larger	
	Area	Owners	Area	Owners [2]	Area	Owners	Area	Owners	Area	Owners	Area	Owners
	Thousand acres	*Number*	*Thousand acres*	*Number*	*Thousand acres*	*Number*	*Thousand acres*	*Number*	*Thousand acres*	*Number*	*Thousand acres*	*Number*
Massachusetts	2, 860	29, 758	1, 214	25, 175	1, 262	4, 316	301	262	83	5		
Michigan	12, 462	174, 422	5, 301	158, 702	3, 018	15, 041	562	610	941	55	2, 640	14
Minnesota	7, 940	140, 562	4, 168	123, 431	2, 699	16, 564	329	548	744	19	[4]	[4]
Mississippi	14, 722	133, 394	3, 822	103, 444	4, 490	27, 500	3, 156	2, 348	1, 498	90	1, 756	12
Missouri	13, 447	201, 025	6, 331	175, 343	4, 782	24, 596	1, 630	1, 054	704	32	[4]	[4]
Montana	4, 857	14, 536	295	7, 374	840	5, 471	1, 625	1, 671	222	16	1, 875	4
Nebraska	1, 419	53, 831	1, 397	53, 731	22	100						
Nevada	77	180	4	82	15	68	58	30	[3]	[3]		
New Hampshire	4, 000	49, 373	1, 125	35, 401	1, 672	13, 463	492	482	711	27	[4]	[4]
New Jersey	1, 729	27, 150	623	24, 920	215	1, 272	746	952	145	6	[4]	[4]
New Mexico	1, 733	2, 037	32	718	235	1, 076	328	196	453	40	685	7
New York	11, 107	254, 942	6, 194	238, 231	2, 305	15, 470	901	1, 174	843	59	864	8
North Carolina	17, 393	267, 056	7, 105	231, 565	5, 745	34, 080	1, 727	1, 294	1, 269	108	1, 547	9
North Dakota	255	8, 500	255	8, 500								
Ohio	5, 099	149, 529	3, 383	141, 228	1, 420	8, 150	183	143	113	8		
Oklahoma	5, 548	82, 033	2, 213	71, 875	1, 699	9, 541	462	582	1, 174	35	[4]	[4]
Oregon	9, 768	36, 253	869	23, 921	2, 010	10, 273	2, 144	1, 917	2, 129	127	2, 616	15
Pennsylvania	11, 879	301, 604	6, 715	277, 563	3, 159	22, 710	852	1, 261	830	65	323	5
Rhode Island	404	12, 330	209	11, 110	155	1, 190	40	30				
South Carolina	10, 975	116, 215	3, 117	88, 795	3, 959	24, 965	1, 551	2, 355	1, 080	91	1, 268	9
South Dakota	596	17, 963	408	17, 602	143	353	45	8	[3]	[3]		
Tennessee	11, 129	185, 133	4, 618	164, 929	2, 955	19, 065	1, 543	1, 021	1, 514	111	499	7
Texas	11, 536	119, 707	3, 050	96, 379	3, 360	22, 445	1, 008	788	1, 042	79	3, 076	16
Utah	392	748	21	329	40	226	248	184	83	9		
Vermont	3, 416	39, 912	1, 232	29, 257	1, 569	10, 557	94	70	521	28	[4]	[4]
Virginia	13, 768	211, 187	4, 928	176, 996	5, 178	31, 643	2, 217	2, 472	740	69	705	7
Washington	9, 806	47, 667	1, 323	35, 920	2, 206	10, 547	1, 402	1, 118	861	64	4, 014	18
West Virginia	8, 878	133, 571	3, 617	120, 126	2, 240	12, 660	574	673	1, 596	102	851	10
Wisconsin	11, 431	176, 906	6, 304	159, 776	3, 213	16, 250	786	852	465	22	663	6
Wyoming	412	802	23	454	69	224	320	124	[3]	[3]		
Coastal Alaska	19	286	10	246	9	40						

[1] The determination of size class of ownership was based on the total commercial forest land in the ownership within the State.
[2] Includes ownerships containing 3 to 100 acres of commercial forest land in the East and 10 to 100 acres in the West.
[3] Included in the 500- to 5,000-acre size class in order to avoid possible disclosure of individual owners.
[4] Included in the 5,000- to 50,000-acre size class in order to avoid possible disclosure of individual owners.

TABLE 5.—*Commercial forest land area in private ownership in the United States and Coastal Alaska and number of private owners, by type of ownership and State, 1953*

State	All ownerships		Farm		Forest industries		Other private	
	Area	Owners	Area	Owners	Area	Owners	Area	Owners
	Thousand acres	*Number*	*Thousand acres*	*Number*	*Thousand acres*	*Number*	*Thousand acres*	*Number*
Alabama	19, 790	169, 821	8, 114	131, 057	3, 138	1, 522	8, 538	37, 242
Arizona	125	458	46	287	2	8	77	163
Arkansas	16, 382	160, 957	6, 733	123, 184	4, 118	760	5, 531	37, 013
California	8, 053	10, 464	1, 586	2, 675	3, 389	385	3, 078	7, 404
Colorado	1, 613	4, 333	994	2, 168			619	2, 165
Connecticut	1, 818	45, 719	526	11, 096	3	108	1, 289	34, 515
Delaware	435	7, 576	217	6, 543	124	173	94	860
Florida	19, 268	93, 583	8, 905	52, 821	4, 369	581	5, 994	40, 181
Georgia	22, 287	196, 665	15, 854	172, 314	4, 246	1, 434	2, 187	22, 917
Idaho	2, 967	10, 831	1, 166	4, 669	1, 180	18	621	6, 144
Illinois	3, 712	131, 101	3, 050	116, 467	10	633	652	14, 001
Indiana	3, 762	126, 190	2, 878	108, 319	9	184	875	17, 687
Iowa	2, 463	34, 738	2, 321	31, 078			142	3, 660
Kansas	1, 663	57, 514	1, 160	56, 962			503	552
Kentucky	10, 721	243, 488	4, 903	207, 916	308	1, 329	5, 510	34, 243
Louisiana	15, 051	111, 654	3, 160	58, 088	4, 281	406	7, 610	53, 160
Maine	16, 419	77, 479	2, 232	30, 401	6, 617	580	7, 570	46, 498
Maryland	2, 683	39, 544	1, 169	29, 695	57	4	1, 457	9, 845
Massachusetts	2, 860	29, 758	740	8, 697	259	134	1, 861	20, 927
Michigan	12, 462	174, 422	3, 877	126, 642	1, 447	208	7, 138	47, 572
Minnesota	7, 940	140, 562	4, 881	101, 298	578	375	2, 481	38, 889
Mississippi	14, 722	133, 394	6, 958	100, 712	2, 602	594	5, 162	32, 088
Missouri	13, 447	201, 025	8, 498	168, 435	460	608	4, 489	31, 982
Montana	4, 857	14, 536	2, 360	4, 930	1, 086	4	1, 411	9, 602

See footnotes at end of table.

TABLE 5.—*Commercial forest land area in private ownership in the United States and Coastal Alaska and number of private owners, by type of ownership and State, 1953*—Continued

State	All ownerships		Farm		Forest industries		Other private	
	Area	Owners	Area	Owners	Area	Owners	Area	Owners
	Thousand acres	*Number*	*Thousand acres*	*Number*	*Thousand acres*	*Number*	*Thousand acres*	*Number*
Nebraska	1,419	53,831	820	53,831			599	(1)
Nevada	77	180	11	40	13	11	53	129
New Hampshire	4,000	49,373	1,039	15,397	771	752	2,190	33,224
New Jersey	1,729	27,150	320	11,837	(2)	(2)	1,409	15,313
New Mexico	1,733	2,037	1,355	1,789	136	8	242	240
New York	11,107	254,942	3,473	167,731	1,172	1,196	6,462	86,015
North Carolina	17,393	267,056	13,590	222,110	2,584	1,959	1,219	42,987
North Dakota	255	8,500	182	8,500			73	(1)
Ohio	5,099	149,529	3,047	134,406	30	287	2,022	14,836
Oklahoma	5,548	82,033	2,240	52,154	944	15	2,364	29,864
Oregon	9,768	36,253	3,458	22,835	4,733	1,236	1,577	12,182
Pennsylvania	11,879	301,604	3,424	229,620	442	1,271	8,013	70,713
Rhode Island	404	12,330	79	2,846			325	9,484
South Carolina	10,975	116,215	7,530	103,438	1,696	732	1,749	12,045
South Dakota	596	17,963	523	17,786	6		67	177
Tennessee	11,129	185,133	6,126	160,174	1,088	302	3,915	24,657
Texas	11,536	119,707	3,125	81,389	3,123	2,629	5,288	35,689
Utah	392	748	343	551	5	6	44	191
Vermont	3,416	39,912	1,522	25,833	528	473	1,366	13,606
Virginia	13,768	211,187	8,848	149,316	1,334	1,271	3,586	60,600
Washington	9,806	47,667	1,886	22,574	4,147	743	3,773	24,350
West Virginia	8,878	133,571	3,197	97,906	270	282	5,411	35,383
Wisconsin	11,431	176,906	6,426	143,389	1,014	229	3,991	33,288
Wyoming	412	802	325	596	(2)	(2)	87	206
Coastal Alaska	19	286					19	286

[1] Number of owners not estimated because of insufficient sampling.
[2] Included with other private to avoid possible disclosure of individual ownership.

TABLE 6.—*Net volume of live sawtimber in sawtimber stands and other stands, and net volume of salvable dead sawtimber, on commercial forest land in the United States and Coastal Alaska, by softwoods and hardwoods, and section, region, and State, January 1, 1953* [1]

Section, region, and State	Live sawtimber										Salvable dead sawtimber		
	Total				Sawtimber stands			Other stands [2]			Total	Softwood	Hardwood
	All species		Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood			
	Million bd.-ft.	*Percent*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
North:													
New England:													
Connecticut	1,859	0.09	263	1,596	1,068	170	898	791	93	698			
Maine	28,226	1.37	16,898	11,328	24,839	14,870	9,969	3,387	2,028	1,359			
Massachusetts	2,659	.13	1,299	1,360	1,411	714	697	1,248	585	663			
New Hampshire	10,069	.49	5,527	4,542	8,446	4,858	3,588	1,623	669	954			
Rhode Island	165	.01	29	136	40	6	34	125	23	102			
Vermont	8,547	.42	3,153	5,394	7,538	2,759	4,779	1,009	394	615			
Total	51,525	2.51	27,169	24,356	43,342	23,377	19,965	8,183	3,792	4,391			
Middle Atlantic:													
Delaware	1,234	.06	518	716	1,120	472	648	114	46	68			
Maryland	6,771	.33	1,526	5,245	6,202	1,398	4,804	569	128	441	40		40
New Jersey	1,660	.08	351	1,309	684	111	573	976	240	736			
New York	26,883	1.31	6,517	20,366	23,048	5,676	17,372	3,835	841	2,994			
Pennsylvania	19,306	.94	2,881	16,425	13,167	1,865	11,302	6,139	1,016	5,123			
West Virginia	18,497	.89	1,535	16,962	16,217	1,285	14,932	2,280	250	2,030	1,328		1,328
Total	74,351	3.61	13,328	61,023	60,438	10,807	49,631	13,913	2,521	11,392	1,368		1,368
Lake States:													
Michigan	21,141	1.03	5,469	15,672	13,411	2,930	10,481	7,730	2,539	5,191	29	9	20
Minnesota	12,538	.61	5,039	7,499	7,735	2,531	5,204	4,803	2,508	2,295	14	8	6
Wisconsin	16,111	.78	3,847	12,264	9,838	2,282	7,556	6,273	1,565	4,708	26	7	19
Total	49,790	2.42	14,355	35,435	30,984	7,743	23,241	18,806	6,612	12,194	69	24	45
Central:													
Illinois	11,694	.57	44	11,650	10,311	43	10,268	1,383	1	1,382			
Indiana	11,671	.57	54	11,617	10,750	44	10,706	921	10	911			
Iowa	4,119	.20		4,119	3,374		3,374	745		745			
Kentucky	27,342	1.33	2,167	25,175	23,630	1,791	21,839	3,712	376	3,336	481		[3] 481
Missouri	13,195	.64	809	12,386	6,406	518	5,888	6,789	291	6,498			
Ohio	14,650	.71	346	14,304	13,127	275	12,852	1,523	71	1,452	32		[3] 32
Total	82,671	4.02	3,420	79,251	67,598	2,671	64,927	15,073	749	14,324	513		513

See footnotes at end of table.

TABLE 6.—*Net volume of live sawtimber in sawtimber stands and other stands, and net volume of salvable dead sawtimber, on commercial forest land in the United States and Coastal Alaska, by softwoods and hardwoods, and section, region, and State, January 1, 1953* [1]—Continued

Section, region, and State	Live sawtimber										Salvable dead sawtimber		
	Total				Sawtimber stands			Other stands [2]			Total	Softwood	Hardwood
	All species		Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood			
North—Continued	*Million bd.-ft.*	*Percent*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Plains:													
Kansas	3,371	0.16	6	3,365	3,019		3,019	352	6	346			
Nebraska	1,253	.06	187	1,066	1,170	157	1,013	83	30	53			
North Dakota	653	.03		653	586		586	67		67	1		1
Oklahoma (West)	880	.04		880	530		530	350		350	4		4
South Dakota (East)	790	.04	107	683	611	101	510	179	6	173	30	2	28
Texas (West)	730	.04	370	360	480	260	220	250	110	140	4	2	2
Total	7,677	.37	670	7,007	6,396	518	5,878	1,281	152	1,129	39	4	35
Total, North	266,014	12.93	58,942	207,072	208,758	45,116	163,642	57,256	13,826	43,430	1,989	28	1,961
South:													
South Atlantic:													
North Carolina	44,152	2.15	22,459	21,693	33,535	17,315	16,220	10,617	5,144	5,473	[4] 45	3	[4] 42
South Carolina	32,299	1.57	18,876	13,423	28,085	16,096	11,989	4,214	2,780	1,434	6	5	1
Virginia	30,407	1.48	9,809	20,598	21,982	6,747	15,235	8,425	3,062	5,363	[5] 27	1	[5] 26
Total	106,858	5.20	51,144	55,714	83,602	40,158	43,444	23,256	10,986	12,270	78	9	69
Southeast:													
Alabama	38,211	1.86	21,929	16,282	28,134	16,912	11,222	10,077	5,017	5,060	231	118	113
Florida	23,032	1.12	18,064	4,968	14,990	11,253	3,737	8,042	6,811	1,231	5	4	1
Georgia	36,920	1.79	23,112	13,808	25,735	15,944	9,791	11,185	7,168	4,017	[6] 21	8	[6] 13
Mississippi	25,789	1.25	11,138	14,651	21,026	9,274	11,752	4,763	1,864	2,899	185	67	118
Tennessee	15,350	.75	2,590	12,760	9,770	1,792	7,978	5,580	798	4,782	220	18	202
Total	139,302	6.77	76,833	62,469	99,655	55,175	44,480	39,647	21,658	17,989	[6] 662	215	[6] 447
West Gulf:													
Arkansas	38,317	1.86	17,777	20,540	29,269	15,359	13,910	9,048	2,418	6,630	184	78	106
Louisiana	41,436	2.01	18,208	23,228	35,602	16,016	19,586	5,834	2,192	3,642	159	78	81
Oklahoma (East)	5,580	.27	2,230	3,350	3,620	1,740	1,880	1,960	490	1,470	28	10	18
Texas (East)	25,575	1.25	16,741	8,834	19,593	14,076	5,517	5,982	2,665	3,317	93	60	33
Total	110,908	5.39	54,956	55,952	88,084	47,191	40,893	22,824	7,765	15,059	464	226	238
Total, South	357,068	17.36	182,933	174,135	271,341	142,524	128,817	85,727	40,409	45,318	1,204	450	754
West:													
Pacific Northwest:													
Douglas-fir subregion	594,375	28.90	577,116	17,259	572,799	556,152	16,647	21,576	20,964	612	23,446	23,367	79
Pine subregion	154,501	7.51	154,317	184	147,491	147,344	147	7,010	6,973	37	2,469	2,469	
Total	748,876	36.41	731,433	17,443	720,290	703,496	16,794	28,586	27,937	649	25,915	25,836	79
Oregon	433,809	21.09	424,721	9,088	418,872	410,101	8,771	14,937	14,620	317	17,015	16,974	41
Washington	315,067	15.32	306,712	8,355	301,418	293,395	8,023	13,649	13,317	332	8,900	8,862	38
Total	748,876	36.41	731,433	17,443	720,290	703,496	16,794	28,586	27,937	649	25,915	25,836	79
California	360,001	17.50	354,024	5,977	351,477	346,359	5,118	8,524	7,665	859	1,570	1,570	(7)
Northern Rocky Mountains:													
Idaho	96,015	4.67	95,809	206	92,621	92,421	200	3,394	3,388	6	2,693	2,692	1
Montana	55,770	2.71	55,075	695	45,916	45,309	607	9,854	9,766	88	1,209	1,209	
South Dakota (West)	3,167	.15	3,167		2,983	2,983		184	184		89	89	
Wyoming	12,070	.59	11,631	439	11,296	11,177	119	774	454	320	289	269	20
Total	167,022	8.12	165,682	1,340	152,816	151,890	926	14,206	13,792	414	4,280	4,259	21
Southern Rocky Mountains:													
Arizona	19,988	.97	19,817	171	19,790	19,628	162	198	189	9	387	386	1
Colorado	25,394	1.23	23,777	1,617	22,819	21,504	1,315	2,575	2,273	302	1,217	1,200	17
Nevada	572	.03	565	7	549	546	3	23	19	4	1	1	
New Mexico	15,054	.73	14,038	1,016	14,144	13,304	840	910	734	176	192	189	3
Utah	7,800	.39	7,392	408	7,531	7,133	398	269	259	10	440	353	87
Total	68,808	3.35	65,589	3,219	64,833	62,115	2,718	3,975	3,474	501	2,237	2,129	108
Total, West	1,344,707	65.38	1,316,728	27,979	1,289,416	1,263,860	25,556	55,291	52,868	2,423	34,002	33,794	208
United States	1,967,789	95.67	1,558,603	409,186	1,769,515	1,451,500	318,015	198,274	107,103	91,171	37,195	34,272	2,923
Coastal Alaska	89,058	4.33	88,951	107	88,533	88,427	106	525	524	1	320	320	
All regions	2,056,847	100.00	1,647,554	409,293	1,858,048	1,539,927	318,121	198,799	107,627	91,172	37,515	34,592	2,923

[1] Net volume in board-feet log scale, International ¼-inch rule. This table is similar in format to table 3 of Basic Forest Statistics for the United States, January 1945 (revised 1950 issue), but the data are not directly comparable because of changes in standards between 1945 and 1952.

[2] Poletimber and seedling and sapling stands and nonstocked and other areas.

[3] Dead chestnut.

[4] Includes 41 million board-feet of dead chestnut.

[5] Includes 25 million board-feet of dead chestnut.

[6] Includes 9 million board-feet of dead chestnut.

[7] Less than 0.5 million board-feet.

TABLE 7.—*Net volume of live sawtimber on commercial forest land in the United States and Coastal Alaska, by species group and section, region, and State, January 1, 1953* [1]

EASTERN SOFTWOODS

Section, region, and State	Total	White and red pine	Jack pine	Longleaf and slash pine	Shortleaf and loblolly pine	Spruce and balsam fir	Hemlock	Cypress	Other
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
North:									
New England:									
Connecticut	263	71					184		8
Maine	16, 898	3, 082				11, 562	1, 149		1, 105
Massachusetts	1, 299	858	1			24	381		35
New Hampshire	5, 527	3, 029				1, 255	1, 111		132
Rhode Island	29	26							3
Vermont	3, 153	536				1, 599	924		94
Total	27, 169	7, 602	1			14, 440	3, 749		1, 377
Middle Atlantic:									
Delaware	518				443				75
Maryland	1, 526	32			1, 061				433
New Jersey	351				62		9		280
New York	6, 517	2, 287	20			1, 655	2, 314		241
Pennsylvania	2, 881	980				18	1, 345		538
West Virginia	1, 535	278			159	264	344		490
Total	13, 328	3, 577	20		1, 725	1, 937	4, 012		2, 057
Lake States:									
Michigan	5, 469	1, 504	308			1, 076	1, 695		886
Minnesota	5, 039	1, 716	1, 421			1, 340			562
Wisconsin	3, 847	1, 795	354			281	1, 040		377
Total	14, 355	5, 015	2, 083			2, 697	2, 735		1, 825
Central:									
Illinois	44							21	23
Indiana	54				42			2	10
Iowa									
Kentucky	2, 167	68			1, 085		320	42	652
Missouri	809				536			215	58
Ohio	346				234		112		
Total	3, 420	68			1, 897		432	280	743
Plains:									
Kansas	6								6
Nebraska	187								[2] 187
North Dakota									
Oklahoma (West)									
South Dakota (East)	107								[2] 107
Texas (West)	370				370			(3)	(3)
Total	670				370			(3)	300
Total, North	58, 942	16, 262	2, 104		3, 992	19, 074	10, 928	280	6, 302
South:									
South Atlantic:									
North Carolina	22, 459	257		721	16, 853	10	711	1, 216	2, 691
South Carolina	18, 876	15		2, 463	13, 621		29	1, 162	1, 586
Virginia	9, 809	465			6, 494		373	383	2, 094
Total	51, 144	737		3, 184	36, 968	10	1, 113	2, 761	6, 371
Southeast:									
Alabama	21, 929			5, 151	15, 297		19	416	1, 046
Florida	18, 064			12, 551	1, 518			3, 178	817
Georgia	23, 112	121		11, 052	9, 532		49	1, 566	792
Mississippi	11, 138			2, 329	7, 666			722	421
Tennessee	2, 590	210			1, 065		224	215	876
Total	76, 833	331		31, 083	35, 078		292	6, 097	3, 952
West Gulf:									
Arkansas	17, 777				16, 978			775	24
Louisiana	18, 208			1, 153	14, 337			2, 410	308
Oklahoma (East)	2, 230				2, 223			4	3
Texas (East)	16, 741			1, 218	15, 168			355	
Total	54, 956			2, 371	48, 706			3, 544	335
Total, South	182, 933	1, 068		36, 638	120, 752	10	1, 405	12, 402	10, 658
Total, Eastern United States	241, 875	17, 330	2, 104	36, 638	124, 744	19, 084	12, 333	12, 682	16, 960

See footnotes at end of table.

TABLE 7.—*Net volume of live sawtimber on commercial forest land in the United States and Coastal Alaska, by species group and section, region, and State, January 1, 1953* [1]—Continued

EASTERN HARDWOODS

Section, region, and State	Total	White oak [4]	Red oak [5]	Other oaks	Yellow birch and sugar maple	Soft maple and beech	Sweet-gum	Tupelo and black-gum	Hickory	Yellow-poplar	Ash, basswood and black walnut	Cotton-wood and aspen	Other
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
North:													
New England:													
Connecticut	1, 596	260	503	244	134	202		2	79	97	31		44
Maine	11, 328		173		6, 226	335					52	252	4, 290
Massachusetts	1, 360	90	405	113	243	242			6	10	122	2	127
New Hampshire	4, 542	45	372		2, 422	1, 072					145	18	468
Rhode Island	136	28	46	29	2	18		1	8		4		
Vermont	5, 394		210		3, 112	1, 284					113	76	599
Total	24, 356	423	1, 709	386	12, 139	3, 153		3	93	107	467	348	5, 528
Middle Atlantic:													
Delaware	716	218	185			92	128	8	22	37	2		24
Maryland	5, 245	1, 002	708	729		472	608	168	226	965			367
New Jersey	1, 309	258	470		72	161	131	22	40	76	44	2	33
New York	20, 366	855	1, 629	143	7, 596	5, 010			265	102	1, 996	265	2, 505
Pennsylvania	16, 425	1, 748	3, 579	2, 837	1, 357	2, 572	16	83	441	634	873	42	2, 243
West Virginia	16, 962	2, 782	3, 607	1, 583	2, 188	2, 171		373	1, 052	1, 221	849		1, 136
Total	61, 023	6, 863	10, 178	5, 292	11, 213	10, 478	883	654	2, 046	3, 035	3, 764	309	6, 308
Lake States:													
Michigan	15, 672	784	1, 337	722	5, 099	2, 241			119		1, 140	1, 234	2, 996
Minnesota	7, 499	174	1, 218	540	314	104			9		1, 308	1, 927	1, 905
Wisconsin	12, 264	1, 007	3, 045	667	2, 557	770			22		1, 763	797	1, 636
Total	35, 435	1, 965	5, 600	1, 929	7, 970	3, 115			150		4, 211	3, 958	6, 537
Central:													
Illinois	11, 650	2, 399	1, 172	3, 022	262	782	135	36	789	161	540	336	2, 016
Indiana	11, 617	1, 375	1, 044	2, 094	908	1, 226	171	130	929	614	925	162	2, 039
Iowa	4, 119	380	381	435	118	268			199		730	390	1, 218
Kentucky	25, 175	2, 567	1, 692	8, 647	583	2, 535	512	648	2, 918	2, 029	1, 323	138	1, 583
Missouri	12, 386	2, 811	491	5, 057	92	229	51	140	774	8	477	465	1, 791
Ohio	14, 304	1, 762	1, 114	2, 733	879	1, 514	41	63	1, 079	837	1, 161	126	2, 995
Total	79, 251	11, 294	5, 894	21, 988	2, 842	6, 554	910	1, 017	6, 688	3, 649	5, 156	1, 617	11, 642
Plains:													
Kansas	3, 365		173	679					39		128	858	1, 488
Nebraska	1, 066			104							118	227	617
North Dakota	653			35							143	216	259
Oklahoma (West)	880	(3)	(3)	185		35	70	53	9		79	44	405
South Dakota (East)	683			10							202	319	152
Texas (West)	360	7	(3)	108		7	90	29	7		14	18	80
Total	7, 007	7	173	1, 121		42	160	82	55		684	1, 682	3, 001
Total, North	207. 072	20, 552	23, 554	30, 716	34, 164	23, 342	1, 953	1. 756	9, 032	6, 791	14, 282	7, 914	33, 016
South:													
South Atlantic:													
North Carolina	21, 693	2, 473	1, 353	4, 807	45	1, 038	2, 805	4, 190	1, 295	2, 062	662	6	957
South Carolina	13, 423	460	196	2, 518		788	2, 612	3, 661	634	1, 302	522	70	660
Virginia	20, 598	2, 731	1, 027	6, 630	121	1, 129	1, 510	1, 023	1, 606	2, 311	504	12	1, 994
Total	55, 714	5, 664	2, 576	13, 955	166	2, 955	6, 927	8, 874	3, 535	5, 675	1, 688	88	3, 611
Southeast:													
Alabama	16, 282	1, 419	662	4, 146	59	548	2, 317	2, 308	1, 935	1, 057	420	64	1, 347
Florida	4, 968	110	14	1, 092		237	641	1, 606	176	41	259		792
Georgia	13, 808	838	499	3, 493	7	529	2, 107	2, 919	864	1, 220	325	25	982
Mississippi	14, 651	988	514	4, 332	9	471	2, 691	1, 091	1, 541	432	291	392	1, 899
Tennessee	12, 760	1, 770	864	4, 204	153	514	543	449	1, 595	1, 095	453	77	1, 043
Total	62, 469	5, 125	2, 553	17, 267	228	2, 299	8, 299	8, 373	6, 111	3, 845	1, 748	558	6, 063
West Gulf:													
Arkansas	20, 540	2, 144	1, 244	7, 696	33	227	2, 647	1, 288	1, 957	5	484	358	2, 457
Louisiana	23, 228	904	431	5, 590	14	801	4, 048	3, 250	2, 103	54	1, 296	435	4, 302
Oklahoma (East)	3, 350	382	198	1, 598		33	100	135	536		67	10	291
Texas (East)	8, 834	661	467	3, 112	25	144	1, 776	887	622		334	13	793
Total	55, 952	4, 091	2, 340	17, 996	72	1, 205	8, 571	5, 560	5, 218	59	2, 181	816	7, 843
Total, South	174, 135	14, 880	7, 469	49, 218	466	6, 459	23, 797	22, 807	14, 864	9, 579	5, 617	1, 462	17, 517
Total, Eastern United States	381, 207	35, 432	31, 023	79, 934	34, 630	29, 801	25, 750	24, 563	23, 896	16, 370	19, 899	9, 376	50, 533

See footnotes at end of table.

TABLE 7.—*Net volume of live sawtimber on commercial forest land in the United States and Coastal Alaska, by species group and section, region, and State, January 1, 1953* [1]—Continued

WESTERN SPECIES

Section, region, and State	Total all species	Softwoods										Hardwoods			
		Total	Douglas-fir	Ponderosa and Jeffrey pine	True firs	Western hemlock	Sugar pine and western white pine	Redwood	Spruce	Lodgepole pine	Other	Total	Cottonwood and aspen	Red alder	Other
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
West:															
Pacific Northwest:															
Douglas-fir subregion	594, 375	577, 116	337, 251	5, 900	58, 428	112, 065	10, 662	90	9, 533	334	42, 853	17, 259		9, 245	8, 014
Pine subregion	154, 501	154, 317	28, 661	86, 332	15, 080	2, 670	1, 846		2, 961	3, 219	13, 548	184	123		61
Total	748, 876	731, 433	365, 912	92, 232	73, 508	114, 735	12, 508	90	12, 494	3, 553	56, 401	17, 443	123	9, 245	8, 075
Oregon	433, 809	424, 721	256, 238	72, 295	31, 316	27, 023	9, 239	90	3, 585	2, 303	22, 632	9, 088	39	3, 941	5, 108
Washington	315, 067	306, 712	109, 674	19, 937	42, 192	87, 712	3, 269		8, 909	1, 250	33, 769	8, 355	84	5, 304	2, 967
Total	748, 876	731, 433	365, 912	92, 232	73, 508	114, 735	12, 508	90	12, 494	3, 553	56, 401	17, 443	123	9, 245	8, 075
California	360, 001	354, 024	116, 912	66, 741	88, 717	478	29, 515	36, 124	170	3, 807	11, 560	5, 977	37	166	5, 774
Northern Rocky Mountain:															
Idaho	96, 015	95, 809	26, 586	17, 386	15, 530	2, 113	13, 381		7, 695	3, 824	9, 294	206	8		198
Montana	55, 770	55, 075	15, 329	10, 969	1, 002	171	1, 093		6, 913	6, 945	12, 653	695	16		679
South Dakota (West)	3, 167	3, 167		3, 118					49						
Wyoming	12, 070	11, 631	1, 305	1, 588	451				3, 080	5, 122	85	439	439		
Total	167, 022	165, 682	43, 220	33, 061	16, 983	2, 284	14, 474		17, 737	15, 891	22, 032	1, 340	463		877
Southern Rocky Mountain:															
Arizona	19, 988	19, 817	1, 449	17, 534	454				181		199	171	171		
Colorado	25, 394	23, 777	1, 343	2, 963	2, 333				12, 474	4, 610	54	1, 617	1, 563		54
Nevada	572	565		331	177		7		3	33	14	7	4	3	
New Mexico	15, 054	14, 038	1, 646	9, 672	1, 160				1, 413		147	1, 016	1, 016		
Utah	7, 800	7, 392	1, 386	1, 675	373				1, 783	2, 157	18	408	365		43
Total	68, 808	65, 589	5, 824	32, 175	4, 497		7		15, 854	6, 800	432	3, 219	3, 119	3	97
Total, Western United States	1, 344, 707	1, 316, 728	531, 868	224, 209	183, 705	117, 497	56, 504	36, 214	46, 255	30, 051	90 425	27, 979	3, 742	9, 414	14, 823
Coastal Alaska	89, 058	88, 951				54, 398			26, 768	75	7, 710	107			107
Total, Western United States and Coastal Alaska	1, 433, 765	1, 405, 679	531, 868	[6]224,209	183, 705	171. 895	56, 504	36, 214	73, 023	30, 126	98, 135	28, 086	3, 742	9, 414	14, 930

[1] Net volume in board-feet log scale, International ¼-inch rule. This table is similar in format to table 10 of Basic Forest Statistics for the United States, January 1945 (revised 1950 issue), but the data are not directly comparable because of changes in standards between 1945 and 1952.

[2] Ponderosa pine. The total volume of ponderosa and Jeffrey pine in the United States is 224.503 million board-feet including 294 million board-feet in the Plains Region.

[3] Less than 0.5 million board-feet.

[4] *Quercus alba* and *Q. prinus.*

[5] *Quercus borealis, Q. falcata* var. *pagodaefolia,* and *Q. shumardii.*

[6] Excludes 294 million board-feet of ponderosa pine in the Plains Region.

TABLE 8.—*Net volume of growing stock on commercial forest land in the United States and Coastal Alaska, by class of material and softwoods and hardwoods, and by section, region, and State, January 1, 1953* [1]

Section, region, and State	Growing stock				Sawtimber trees			Poletimber trees		
	Total		Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Million cu. ft.	*Percent*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
North:										
New England:										
Connecticut	1,304	0.25	158	1,146	533	85	448	771	73	698
Maine	12,601	2.44	5,850	6,751	6,397	3,989	2,408	6,204	1,861	4,343
Massachusetts	1,871	.36	631	1,240	786	373	413	1,085	258	827
New Hampshire	4,452	.86	2,065	2,387	2,366	1,359	1,007	2,086	706	1,380
Rhode Island	161	.03	15	146	52	10	42	109	5	104
Vermont	3,956	.77	1,238	2,718	2,175	827	1,348	1,781	411	1,370
Total	24,345	4.71	9,957	14,388	12,309	6,643	5,666	12,036	3,314	8,722
Middle Atlantic:										
Delaware	464	.09	217	247	284	148	136	180	69	111
Maryland	2,899	.56	806	2,093	1,748	469	1,279	1,151	337	814
New Jersey	952	.18	197	755	440	100	340	512	97	415
New York	11,675	2.26	2,544	9,131	6,708	1,796	4,912	4,967	748	4,219
Pennsylvania	10,629	2.06	1,020	9,609	4,443	704	3,739	6,186	316	5,870
West Virginia	7,864	1.52	606	7,258	4,724	413	4,311	3,140	193	2,947
Total	34,483	6.67	5,390	29,093	18.347	3,630	14,717	16,136	1,760	14,376
Lake States:										
Michigan	9,912	1.92	2,278	7,634	4,540	1,191	3,349	5,372	1,087	4,285
Minnesota	7,235	1.40	2,829	4,406	2,746	1,134	1,612	4,489	1,695	2,794
Wisconsin	8,071	1.56	1,436	6,635	3,436	822	2,614	4,635	614	4,021
Total	25,218	4.88	6,543	18,675	10,722	3,147	7,575	14,496	3,396	11,100
Central:										
Illinois	3,050	.59	14	3,036	2,123	12	2,111	927	2	925
Indiana	3,041	.59	26	3,015	2,084	13	2,071	957	13	944
Iowa	1,183	.23	1	1,182	831	----------	831	352	1	351
Kentucky	7,834	1.52	571	7,263	4,853	388	4,465	2,981	183	2,798
Missouri	5,503	1.06	334	5,169	2,810	187	2,623	2,693	147	2,546
Ohio	4,013	.77	96	3,917	2,653	66	2,587	1,360	30	1,330
Total	24,624	4.76	1,042	23,582	15,354	666	14,688	9,270	376	8,894
Plains:										
Kansas	954	.19	8	946	649	3	646	305	5	300
Nebraska	462	.09	65	397	253	36	217	209	29	180
North Dakota	251	.05	1	250	138	----------	138	113	1	112
Oklahoma (West)	337	.06	[2]	337	212	----------	212	125	----------	125
South Dakota (East)	601	.12	55	546	152	20	132	449	35	414
Texas (West)	223	.04	85	138	154	67	87	69	18	51
Total	2,828	.55	214	2,614	1,558	126	1,432	1,270	88	1,182
Total, North	111,498	21.57	23,146	88,352	58,290	14,212	44,078	53,208	8,934	44,274
South:										
South Atlantic:										
North Carolina	13,642	2.64	6,379	7,263	9,038	4,607	4,431	4,604	1,772	2,832
South Carolina	9,613	1.86	5,288	4,325	6,220	3,593	2,627	3,393	1,695	1,698
Virginia	10,503	2.03	3,210	7,293	6,219	2,058	4,161	4,284	1,152	3,132
Total	33,758	6.53	14,877	18,881	21,477	10,258	11,219	12,281	4,619	7,662
Southeast:										
Alabama	11,713	2.27	5,616	6,097	7,688	3,993	3,695	4,025	1,623	2,402
Florida	8,152	1.58	5,942	2,210	4,525	3,502	1,023	3,627	2,440	1,187
Georgia	12,692	2.46	7,773	4,919	8,174	5,213	2,961	4,518	2,560	1,958
Mississippi	9,628	1.86	3,288	6,340	5,489	2,266	3,223	4,139	1,022	3,117
Tennessee	5,770	1.11	882	4,888	3,289	507	2,782	2,481	375	2,106
Total	47,955	9.28	23,501	24,454	29,165	15,481	13,684	18,790	8,020	10,770
West Gulf:										
Arkansas	11,762	2.28	4,318	7,444	7,880	3,297	4,583	3,882	1,021	2,861
Louisiana	11,199	2.17	3,927	7,272	8,496	3,252	5,244	2,703	675	2,028
Oklahoma (East)	1,780	.34	580	1,200	1,166	412	754	614	168	446
Texas (East)	7,247	1.40	3,864	3,383	5,167	3,035	2,132	2,080	829	1,251
Total	31,988	6.19	12,689	19,299	22,709	9,996	12,713	9,279	2,693	6,586
Total, South	113,701	22.00	51,067	62,634	73,351	35,735	37,616	40,350	15,332	25,018

See footnotes at end of table.

TABLE 8.—*Net volume of growing stock on commercial forest land in the United States and Coastal Alaska, by class of material and softwoods and hardwoods, and by section, region, and State, January 1, 1953* [1]—Continued

Section, region, and State	Growing stock				Sawtimber trees			Poletimber trees		
	Total		Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Million cu. ft.	*Percent*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
West:										
Pacific Northwest:										
Douglas-fir subregion	113, 171	21. 89	107, 601	5, 570	101, 055	97, 514	3, 541	12, 116	10, 087	2, 029
Pine subregion	33, 023	6. 39	32, 980	43	27, 729	27, 695	34	5, 294	5, 285	9
Total	146, 194	28. 28	140, 581	5, 613	128, 784	125, 209	3, 575	17, 410	15, 372	2, 038
Oregon	80, 973	15. 66	78, 298	2, 675	72, 455	70, 665	1, 790	8, 518	7, 633	885
Washington	65, 221	12. 62	62, 283	2, 938	56, 329	54, 544	1, 785	8, 892	7, 739	1, 153
Total	146, 194	28. 28	140, 581	5, 613	128, 784	125, 209	3, 575	17, 410	15, 372	2, 038
California	66, 711	12. 90	63, 664	3, 047	61, 756	60, 244	1, 512	4, 955	3, 420	1, 535
Northern Rocky Mountain:										
Idaho	21, 246	4. 11	21, 139	107	15, 691	15, 618	73	5, 555	5, 521	34
Montana	16, 143	3. 12	15, 895	248	9, 002	8, 861	141	7, 141	7, 034	107
South Dakota (West)	1, 287	. 25	1, 287	----------	634	634	----------	653	653	----------
Wyoming	4, 087	. 79	3, 969	118	2, 269	2, 160	109	1, 818	1, 809	9
Total	42, 763	8. 27	42, 290	473	27, 596	27, 273	323	15, 167	15, 017	150
Southern Rocky Mountain:										
Arizona	3, 700	. 72	3, 624	76	3, 254	3, 206	48	446	418	28
Colorado	8, 037	1. 55	7, 470	567	4, 707	4, 410	297	3, 330	3, 060	270
Nevada	151	. 03	126	25	110	109	1	41	17	24
New Mexico	3, 683	. 71	3, 136	547	2, 864	2, 581	283	819	555	264
Utah	2, 001	. 39	1, 578	423	1, 421	1, 334	87	580	244	336
Total	17, 572	3. 40	15, 934	1, 638	12, 356	11, 640	716	5, 216	4, 294	922
Total, West	273, 240	52. 85	262, 469	10, 771	230, 492	224, 366	6, 126	42, 748	38, 103	4, 645
United States	498, 439	96. 42	336, 682	161, 757	362, 133	274, 313	87, 820	136, 306	62, 369	73, 937
Coastal Alaska	18, 496	3. 58	18, 473	23	17, 094	17, 073	21	1, 402	1, 400	2
All regions	516, 935	100. 0	355, 155	161, 780	379, 227	291, 386	87, 841	137, 708	63, 769	73, 939

[1] Net volume excluding bark. This table is similar in format to table 4 of Basic Forest Statistics for the United States, January 1945 (revised 1950 issue), but the data are not directly comparable because of changes in standards between 1945 and 1952.

[2] Less than 0.5 million cubic feet.

TABLE 9.—*Net volume of growing stock on commercial forest land in Eastern United States, by class of material and section, region, and State, January 1, 1953* [1]

Section, region, and State	Growing stock				Sawtimber trees			Poletimber trees		
	Total		Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
	Million cords	*Percent*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*
North:										
New England:										
Connecticut	16.0	0.52	2.0	14.0	7.0	1.0	6.0	9.0	1.0	8.0
Maine	157.0	5.12	73.0	84.0	80.0	50.0	30.0	77.0	23.0	54.0
Massachusetts	23.0	.75	8.0	15.0	10.0	5.0	5.0	13.0	3.0	10.0
New Hampshire	56.0	1.83	26.0	30.0	30.0	17.0	13.0	26.0	9.0	17.0
Rhode Island	2.0	.06	(2)	2.0	1.0	(2)	1.0	1.0	(2)	1.0
Vermont	49.0	1.60	15.0	34.0	27.0	10.0	17.0	22.0	5.0	17.0
Total	303.0	9.88	124.0	179.0	155.0	83.0	72.0	148.0	41.0	107.0
Middle Atlantic:										
Delaware	6.0	.20	3.0	3.0	4.0	2.0	2.0	2.0	1.0	1.0
Maryland	36.0	1.17	10.0	26.0	22.0	6.0	16.0	14.0	4.0	10.0
New Jersey	12.0	.39	3.0	9.0	5.0	1.0	4.0	7.0	2.0	5.0
New York	146.0	4.76	32.0	114.0	84.0	23.0	61.0	62.0	9.0	53.0
Pennsylvania	133.0	4.34	13.0	120.0	56.0	9.0	47.0	77.0	4.0	73.0
West Virginia	98.0	3.20	7.0	91.0	59.0	5.0	54.0	39.0	2.0	37.0
Total	431.0	14.06	68.0	363.0	230.0	46.0	184.0	201.0	22.0	179.0
Lake States:										
Michigan	123.9	4.04	28.5	95.4	56.8	14.9	41.9	67.1	13.6	53.5
Minnesota	90.4	2.95	35.3	55.1	34.3	14.1	20.2	56.1	21.2	34.9
Wisconsin	100.9	3.29	18.0	82.9	43.0	10.3	32.7	57.9	7.7	50.2
Total	315.2	10.28	81.8	233.4	134.1	39.3	94.8	181.1	42.5	138.6
Central:										
Illinois	47.1	1.54	.2	46.9	32.1	.2	31.9	15.0	(3)	15.0
Indiana	47.0	1.53	.4	46.6	31.6	.2	31.4	15.4	.2	15.2
Iowa	18.3	.60	(3)	18.3	12.6	----	12.6	5.7	(3)	5.7
Kentucky	121.6	3.97	8.9	112.7	73.3	5.7	67.6	48.3	3.2	45.1
Missouri	86.1	2.81	5.3	80.8	42.5	2.8	39.7	43.6	2.5	41.1
Ohio	62.1	2.02	1.5	60.6	40.2	1.0	39.2	21.9	.5	21.4
Total	382.2	12.47	16.3	365.9	232.3	9.9	222.4	149.9	6.4	143.5
Plains:										
Kansas	14.8	.48	.1	14.7	9.8	(3)	9.8	5.0	.1	4.9
Nebraska	7.2	.23	1.0	6.2	3.8	.5	3.3	3.4	.5	2.9
North Dakota	3.1	.10	(3)	3.1	1.7	----	1.7	1.4	(3)	1.4
Oklahoma (West)	5.1	.17	(3)	5.1	3.2	----	3.2	1.9	----	1.9
South Dakota (East)	6.0	.20	(3)	6.0	1.0	(3)	1.0	5.0	(3)	5.0
Texas (West)	3.2	.10	1.1	2.1	2.2	.9	1.3	1.0	.2	.8
Total	39.4	1.28	2.2	37.2	21.7	1.4	20.3	17.7	.8	16.9
Total, North	1,470.8	47.97	292.3	1,178.5	773.1	179.6	593.5	697.7	112.7	585.0
South:										
South Atlantic:										
North Carolina	185.0	6.04	86.4	98.6	114.9	58.9	56.0	70.1	27.5	42.6
South Carolina	131.0	4.27	72.3	58.7	79.2	46.0	33.2	51.8	26.3	25.5
Virginia	144.4	4.71	44.5	99.9	79.2	26.6	52.6	65.2	17.9	47.3
Total	460.4	15.02	203.2	257.2	273.3	131.5	141.8	187.1	71.7	115.4
Southeast:										
Alabama	165.9	5.41	74.9	91.0	108.4	53.3	55.1	57.5	21.6	35.9
Florida	113.9	3.72	82.7	31.2	58.3	45.3	13.0	55.6	37.4	18.2
Georgia	174.5	5.69	107.4	67.1	105.1	67.6	37.5	69.4	39.8	29.6
Mississippi	138.4	4.52	43.8	94.6	78.3	30.2	48.1	60.1	13.6	46.5
Tennessee	84.7	2.76	11.7	73.0	48.3	6.7	41.6	36.4	5.0	31.4
Total	677.4	22.10	320.5	356.9	398.4	203.1	195.3	279.0	117.4	161.6
West Gulf:										
Arkansas	168.7	5.50	57.6	111.1	112.4	44.0	68.4	56.3	13.6	42.7
Louisiana	160.9	5.25	52.4	108.5	121.6	43.4	78.2	39.3	9.0	30.3
Oklahoma (East)	25.6	.83	7.7	17.9	16.7	5.5	11.2	8.9	2.2	6.7
Texas (East)	102.0	3.33	51.5	50.5	72.2	40.4	31.8	29.8	11.1	18.7
Total	457.2	14.91	169.2	288.0	322.9	133.3	189.6	134.3	35.9	98.4
Total, South	1,595.0	52.03	692.9	902.1	994.6	467.9	526.7	600.4	225.0	375.4
Total, Eastern United States	3,065.8	100.00	985.2	2,080.6	1,767.7	647.5	1,120.2	1,298.1	337.7	960.4

[1] Net volume in standard cords (128 cu. ft.) including bark.
[2] Less than 0.5 million cords.
[3] Less than 0.05 million cords.

TABLE 10.—*Net volume of growing stock on commercial forest land in the United States and Coastal Alaska, by species group and section, region, and State, January 1, 1953* [1]

EASTERN SOFTWOODS

Section, region, and State	Total		White and red pine		Jack pine		Southern yellow pine		Spruce and balsam fir		Hemlock		Cypress		Other	
	Million cu. ft.	*Million cords*	*Million cu. ft.*	*Million cords*	*Million cu. ft.*	*Million cords*	*Million cu. ft.*	*Million cords*	*Million cu. ft.*	*Million cords*	*Million cu. ft.*	*Million cords*	*Million cu. ft.*	*Million cords*	*Million cu. ft.*	*Million cords*
North:																
New England:																
Connecticut	158	2.0	41	1.0							94	1.0			23	(2)
Maine	5,850	73.0	1,011	13.0					4,118	51.0	304	4.0			417	5.0
Massachusetts	631	8.0	344	4.0			41	1.0	26	(2)	205	3.0			15	(2)
New Hampshire	2,065	26.0	950	12.0					704	9.0	355	4.0			56	1.0
Rhode Island	15	(2)	12	(2)			3	(2)								
Vermont	1,238	15.0	162	2.0					655	8.0	340	4.0			81	1.0
Total	9,957	124.0	2,520	32.0			44	1.0	5,503	68.0	1,298	16.0			592	7.0
Middle Atlantic:																
Delaware	217	3.0					201	3.0							16	(2)
Maryland	806	10.0					772	10.0							34	(2)
New Jersey	197	3.0					156	2.0							41	1.0
New York	2,544	32.0	772	10.0					710	9.0	901	11.0			161	2.0
Pennsylvania	1,020	13.0	347	4.0							476	6.0			197	3.0
West Virginia	606	7.0	75	1.0			303	3.0	108	1.0	110	2.0			10	(2)
Total	5,390	68.0	1,194	15.0			1,432	18.0	818	10.0	1,487	19.0			459	6.0
Lake States:																
Michigan	2,278	28.5	411	5.1	271	3.4			710	8.9	410	5.2			476	5.9
Minnesota	2,829	35.3	454	5.7	771	9.6			1,172	14.6					432	5.4
Wisconsin	1,436	18.0	469	5.9	257	3.2			238	3.0	246	3.1			226	2.8
Total	6,543	81.8	1,334	16.7	1,299	16.2			2,120	26.5	656	8.3			1,134	14.1
Central:																
Illinois	14	.2											5	0.1	9	.1
Indiana	26	.4					18	.3					1	(3)	7	.1
Iowa	1	(3)													1	(3)
Kentucky	571	8.9	10	.2			430	6.7			62	.9	10	.1	59	1.0
Missouri	334	5.3					229	3.7					48	.7	57	.9
Ohio	96	1.5					71	1.1							25	.4
Total	1,042	16.3	10	.2			748	11.8			62	.9	64	.9	158	2.5
Plains:																
Kansas	8	.1													8	.1
Nebraska	[4] 65	1.0													[4] 65	1.0
North Dakota	1	(3)													1	(3)
Oklahoma (West)	(5)	(3)											(5)	(3)	(5)	(3)
South Dakota (East)	[6] 55	(3)													[6] 55	(3)
Texas (West)	85	1.1					85	1.1					(5)	(3)	9 (3)	(3)
Total	214	2.2					85	1.1					(5)	(3)	129	1.1
Total, North	23,146	292.3	5,058	63.9	1,299	16.2	2,309	31.9	8,441	104.5	3,503	44.2	64	.9	2,472	30.7
South:																
South Atlantic:																
North Carolina	6,379	86.4	51	.6			5,843	80.1	14	.2	129	1.4	268	3.1	74	1.0
South Carolina	5,288	72.3	6	.1			4,898	66.6			6	.1	351	5.1	27	.4
Virginia	3,210	44.5	121	1.5			2,901	40.8			89	1.0	77	.9	22	.3
Total	14,877	203.2	178	2.2			13,642	187.5	14	.2	224	2.5	696	9.1	123	1.7
Southeast:																
Alabama	5,616	74.9					5,496	73.3			(5)	(3)	82	1.1	38	.5
Florida	5,942	82.7					4,679	64.7					1,240	17.7	23	.3
Georgia	7,773	107.4	31	.4			7,254	101.1			9	.1	472	5.7	7	.1
Mississippi	3,288	43.8					3,130	41.7					150	2.0	8	.1
Tennessee	882	11.7	52	.7			665	8.8			45	.6	38	.5	82	1.1
Total	23,501	320.5	83	1.1			21,224	289.6			54	.7	1,982	27.0	158	2.1
West Gulf:																
Arkansas	4,318	57.6					4,138	55.2					165	2.2	15	.2
Louisiana	3,927	52.4					3,402	45.4					525	7.0	(5)	(3)
Oklahoma (East)	580	7.7					580	7.7					(5)	(3)	(5)	(3)
Texas (East)	3,864	51.5					3,789	50.5					75	1.0	(5)	(3)
Total	12,689	169.2					11,909	158.8					765	10.2	15	.2
Total, South	51,067	692.9	261	3.3			46,775	635.9	14	.2	278	3.2	3,443	46.3	296	4.0
Eastern United States	74,213	985.2	5,319	67.2	1,299	16.2	49,084	667.8	8,455	104.7	3,781	47.4	3,507	47.2	2,768	34.7

See footnotes at end of table.

TABLE 10.—*Net volume of growing stock on commercial forest land in the United States and Coastal Alaska, by species group and section, region, and State, January 1, 1953* [1]—Continued

EASTERN HARDWOODS

Section, region, and State	Total		Oak		Beech, yellow birch, and hard maple		Hickory		Sweetgum		Tupelo and blackgum		Yellow-poplar		Cottonwood and aspen		Other	
	Million cu. ft.	*Million cords*	*Million cu. ft.*	*Million cords*	*Million cu. ft.*	*Million cords*	*Million cu. ft.*	*Million cords*	*Million cu. ft.*	*Million cords*	*Million cu. ft.*	*Million cords*	*Million cu. ft.*	*Million cords*	*Million cu. ft.*	*Million cords*	*Million cu. ft.*	*Million cords*
North:																		
New England:																		
Connecticut	1, 146	14. 0	596	7. 0	72	2. 0	64	1. 0					23	(2)			391	4. 0
Maine	6, 751	84. 0	83	1. 0	3, 093	39. 0									178	2. 0	3, 397	42. 0
Massachusetts	1, 240	15. 0	491	6. 0	252	3. 0									24	(2)	473	6. 0
New Hampshire	2, 387	30. 0	227	3. 0	1, 144	14. 0									47	1. 0	969	12. 0
Rhode Island	146	2. 0	80	1. 0	4	(2)	6	(2)									56	1. 0
Vermont	2, 718	34. 0	87	1. 0	1, 727	21. 0									96	1. 0	808	11. 0
Total	14, 388	179. 0	1, 564	19. 0	6, 292	79. 0	70	1. 0					23	(2)	345	4. 0	6, 094	76. 0
Middle Atlantic:																		
Delaware	247	3. 0	147	2. 0			13	(2)	54	1. 0					11	(2)	22	(2)
Maryland	2, 093	26. 0	950	12. 0	65	1. 0	99	1. 0	235	3. 0	67	1. 0	279	3. 0			398	5. 0
New Jersey	755	9. 0	401	5. 0	71	1. 0	37	(2)	48	1. 0	10	(2)	36	(2)	10	(2)	142	2. 0
New York	9, 131	114. 0	1, 240	16. 0	3, 952	49. 0	142	2. 0							381	5. 0	3, 416	42. 0
Pennsylvania	9, 609	120. 0	4, 776	60. 0	1, 551	19. 0	258	3. 0					371	5. 0			2, 653	33. 0
West Virginia	7, 258	91. 0	3, 094	39. 0	1, 323	16. 0	578	7. 0			123	2. 0	562	7. 0			1, 578	20. 0
Total	29, 093	363. 0	10, 608	134. 0	6, 962	86. 0	1, 127	13. 0	337	5. 0	200	3. 0	1, 248	15. 0	402	5. 0	8, 209	102. 0
Lake States:																		
Michigan	7, 634	95. 4	1, 134	14. 2	2, 091	26. 1	56	. 7							1, 768	22. 1	2, 585	32. 3
Minnesota	4, 406	55. 1	771	9. 6	139	1. 7	8	. 1							1, 862	23. 3	1, 626	20. 4
Wisconsin	6, 635	82. 9	1, 870	23. 4	920	11. 5	24	. 3							1, 742	21. 7	2, 079	26. 0
Total	18, 675	233. 4	3, 775	47. 2	3, 150	39. 3	88	1. 1							5, 372	67. 1	6, 290	78. 7
Central:																		
Illinois	3, 036	46. 9	1, 520	23. 3	83	1. 3	267	4. 2	39	. 6	9	. 1	36	. 6	66	1. 0	1, 016	15. 8
Indiana	3, 015	46. 6	1, 115	17. 1	379	5. 9	285	4. 5	55	. 9	34	. 5	141	2. 2	35	. 5	971	15. 0
Iowa	1, 182	18. 3	339	5. 2	30	. 5	88	1. 4							85	1. 3	640	9. 9
Kentucky	7, 263	112. 7	3, 566	55. 2	628	9. 7	962	15. 0	158	2. 5	177	2. 7	495	7. 6	27	. 4	1, 250	19. 6
Missouri	5, 169	80. 8	3, 575	55. 9	46	. 7	424	6. 7	18	. 3	38	. 6	4	. 1	126	1. 9	938	14. 6
Ohio	3, 917	60. 6	1, 413	21. 7	398	6. 1	377	5. 9	11	. 2	17	. 3	208	3. 2	24	. 4	1, 469	22. 8
Total	23, 582	365. 9	11, 528	178. 4	1, 564	24. 2	2, 403	37. 7	281	4. 5	275	4. 2	884	13. 7	363	5. 5	6, 284	97. 7
Plains:																		
Kansas	946	14. 7	284	4. 4			23	. 4							148	2. 2	491	7. 7
Nebraska	397	6. 2	94	1. 5			3	(3)							99	1. 6	201	3. 1
North Dakota	250	3. 1	20	. 2											120	1. 5	110	1. 4
Oklahoma (West)	337	5. 1	73	1. 1			(5)	(3)	26	. 4	20	. 3			13	. 2	205	3. 1
South Dakota (East)	546	6. 0													180	2. 0	366	4. 0
Texas (West)	138	2. 1	40	. 6			(5)	(3)	33	. 5	13	. 2			7	. 1	45	. 7
Total	2, 614	37. 2	511	7. 8			26	. 4	59	. 9	33	. 5			567	7. 6	1, 418	20. 0
Total, North	88, 352	1, 178. 5	27, 986	386. 4	17, 968	228. 5	3, 714	53. 2	677	10. 4	508	7. 7	2, 155	28. 7	7, 049	89. 2	28, 295	374. 4
South:																		
South Atlantic:																		
North Carolina	7, 263	98. 6	2, 897	39. 3	102	1. 4	416	5. 6	913	12. 4	1, 204	16. 0	756	10. 4	1	(3)	974	13. 5
South Carolina	4, 325	58. 7	1, 012	12. 7	27	. 4	217	2. 7	797	11. 2	1, 145	16. 2	321	4. 5	31	. 5	775	10. 5
Virginia	7, 293	99. 9	3, 563	48. 6	185	2. 5	644	8. 9	604	9. 3	383	4. 3	704	9. 5	6	. 1	1, 204	16. 7
Total	18, 881	257. 2	7, 472	100. 6	314	4. 3	1, 277	17. 2	2, 314	32. 9	2, 732	36. 5	1, 781	24. 4	38	. 6	2, 953	40. 7
Southeast:																		
Alabama	6, 097	91. 0	2, 278	34. 0	121	1. 8	777	11. 6	884	13. 2	838	12. 5	308	4. 6	20	. 3	871	13. 0
Florida	2, 210	31. 2	430	6. 3	16	. 2	63	1. 0	263	3. 6	728	10. 1	30	. 4	1	(3)	679	9. 6
Georgia	4, 919	67. 1	1, 605	21. 7	24	. 3	291	3. 9	769	10. 5	1, 142	15. 7	378	5. 1	6	. 1	704	9. 8
Mississippi	6, 340	94. 6	2, 488	37. 1	100	1. 5	583	8. 7	1, 340	20. 0	523	7. 8	161	2. 4	107	1. 6	1, 038	15. 5
Tennessee	4, 888	73. 0	2, 522	37. 7	168	2. 5	704	10. 5	208	3. 1	161	2. 4	375	5. 6	20	. 3	730	10. 9
Total	24, 454	356. 9	9, 323	136. 8	429	6. 3	2, 418	35. 7	3, 464	50. 4	3, 392	48. 5	1, 252	18. 1	154	2. 3	4, 022	58. 8
West Gulf:																		
Arkansas	7, 444	111. 1	4, 012	59. 9	34	. 5	804	12. 0	972	14. 5	389	5. 8	(5)	(3)	94	1. 4	1, 139	17. 0
Louisiana	7, 272	108. 5	2, 073	30. 9	154	2. 3	603	9. 0	1, 273	19. 0	1, 092	16. 3	13	. 2	114	1. 7	1, 950	29. 1
Oklahoma (East)	1, 200	17. 9	784	11. 7	(5)	(3)	194	2. 9	34	. 5	47	. 7					141	2. 1
Texas (East)	3, 383	50. 5	1, 621	24. 2	47	. 7	234	3. 5	670	10. 0	288	4. 3	(5)	(3)	7	. 1	516	7. 7
Total	19, 299	288. 0	8, 490	126. 7	235	3. 5	1, 835	27. 4	2, 949	44. 0	1, 816	27. 1	13	. 2	215	3. 2	3, 746	55. 9
Total, South	62, 634	902. 1	25, 285	364. 1	978	14. 1	5, 530	80. 3	8, 727	127. 3	7, 940	112. 1	3, 046	42. 7	407	6. 1	10, 721	155. 4
Eastern United States	150, 986	2, 080. 6	53, 271	750. 5	18, 946	242. 6	9, 244	133. 5	9, 404	137. 7	8, 448	119. 8	5, 201	71. 4	7, 456	95. 3	39, 016	529. 8

See footnotes at end of table.

TABLE 10.—*Net volume of growing stock on commercial forest land in the United States and Coastal Alaska, by species group and section, region, and State, January 1, 1953* [1]—Continued

WESTERN SPECIES

Section, region, and State	Total all species	Softwood										Hardwood			
		Total	Douglas-fir	Ponderosa and Jeffrey pine	True firs	Western hemlock and Sitka spruce	Redwood	Engelmann and other spruces	Lodgepole pine	Larch	Other	Total	Cottonwood and aspen	Red alder	Other
West:															
Pacific Northwest:	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Douglas-fir subregion	113,171	107,601	59,064	856	11,949	25,360	13	76	195	38	10,050	5,570	-	3,426	2,144
Pine subregion	33,023	32,980	5,411	16,130	4,329	508	-	607	2,648	1,618	1,729	43	41	-	2
Total	146,194	140,581	64,475	16,986	16,278	25,868	13	683	2,843	1,656	11,779	5,613	41	3,426	2,146
Oregon	80,973	78,298	42,877	13,071	6,936	7,492	13	106	2,045	410	5,348	2,675	17	1,272	1,386
Washington	65,221	62,283	21,598	3,915	9,342	18,376	-	577	798	1,246	6,431	2,938	24	2,154	760
Total	146,194	140,581	64,475	16,986	16,278	25,868	13	683	2,843	1,656	11,779	5,613	41	3,426	2,146
California	66,711	63,664	20,758	11,935	16,099	113	6,360	-	1,092	-	7,307	3,047	36	57	2,954
Northern Rocky Mountain:															
Idaho	21,246	21,139	5,563	3,096	3,301	506	-	1,399	2,803	1,309	3,162	107	102	-	5
Montana	16,143	15,895	4,684	2,231	422	56	-	1,384	4,077	2,390	651	248	242	-	6
South Dakota (West)	1,287	1,287	-	1,260	-	-	-	27	-	-	-	-	-	-	-
Wyoming	4,087	3,969	450	720	90	-	-	630	2,079	-	-	118	118	-	-
Total	42,763	42,290	10,697	7,307	3,813	562	-	3,440	8,959	3,699	3,813	473	462	-	11
Southern Rocky Mountain:															
Arizona	3,700	3,624	335	3,100	110	-	-	45	-	-	34	76	76	-	-
Colorado	8,037	7,470	450	990	990	-	-	3,150	1,890	-	-	567	540	-	27
Nevada	151	126	-	126	-	-	-	-	-	-	-	25	25	-	-
New Mexico	3,683	3,136	480	1,924	323	-	-	378	-	-	31	547	547	-	-
Utah	2,001	1,578	278	278	93	-	-	371	558	-	-	423	423	-	-
Total	17,572	15,934	1,543	6,418	1,516	-	-	3,944	2,448	-	65	1,638	1,611	-	27
Total, West	273,240	262,469	97,473	[7] 42,646	37,706	26,543	6,373	8,067	15,342	5,355	[8] 22,964	10,771	2,150	3,483	5,138
Coastal Alaska	18,496	18,473	-	-	-	16,724	-	34	17	-	1,698	23	([5])	([5])	23
Western United States and Coastal Alaska	291,736	280,942	97,473	[7] 42,646	37,706	43,267	6,373	8,101	15,359	5,355	[8] 24,662	10,794	2,150	3,483	5,161

[1] Net volume in cubic feet excluding bark and in standard cords (128 cu. ft.) including bark.
[2] Less than 0.5 million cords.
[3] Less than 0.05 million cords.
[4] Includes 64 million cubic feet of ponderosa pine.
[5] Less than 0.5 million cubic feet.
[6] Ponderosa pine. The total volume of ponderosa and Jeffrey pine in the United States is 42,765 million cubic feet, including 119 million cubic feet of ponderosa pine in the Plains Region.
[7] Excludes 119 million cubic feet of ponderosa pine in the Plains Region.
[8] Includes about 9.5 billion cubic feet of sugar pine and western white pine.

TABLE 11.—*Net volume of growing stock and live sawtimber on commercial forest land in the United*

Section, region, and State	Growing stock					
	All ownerships	Federal ownership or trusteeship				
		Total	National forest	Indian [2]	Bureau of Land Management [2]	Other [2]
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
North:						
New England:						
Connecticut	1,304	1				1
Maine	12,601	84	49			35
Massachusetts	1,871	11				11
New Hampshire	4,452	752	751			1
Rhode Island	161					
Vermont	3,956	245	238			7
Total	24,345	1,093	1,038			55
Middle Atlantic:						
Delaware	464	1				1
Maryland	2,899	52				52
New Jersey	952	1				1
New York	11,675	70				70
Pennsylvania	10,629	265	245			20
West Virginia	7,864	669	658			11
Total	34,483	1,058	903			155
Lake States:						
Michigan	9,912	1,183	1,119	8	3	53
Minnesota	7,235	1,769	1,367	348	16	38
Wisconsin	8,071	1,316	713	500	3	100
Total	25,218	4,268	3,199	856	22	191
Central:						
Illinois	3,050	147	122			25
Indiana	3,041	96	50			46
Iowa	1,183	10	1	(4)		9
Kentucky	7,834	527	380			147
Missouri	5,503	548	504		(4)	44
Ohio	4,013	57	57			(4)
Total	24,624	1,385	1,114	(4)	(4)	271
Plains:						
Kansas	954	(4)				(4)
Nebraska	462	50	48	2		
North Dakota	251	91		56		35
Oklahoma (West)	337					
South Dakota (East)	601	259	24	229	4	2
Texas (West)	223					
Total	2,828	400	72	287	4	37
Total, North	111,498	8,204	6,326	1,143	26	709
South:						
South Atlantic:						
North Carolina	13,642	876	708	25		143
South Carolina	9,613	628	472			156
Virginia	10,503	927	781			146
Total	33,758	2,431	1,961	25		445
Southeast:						
Alabama	11,713	492	404		5	83
Florida	8,152	810	525	6	5	274
Georgia	12,692	1,045	464			581
Mississippi	9,628	800	661	7	2	130
Tennessee	5,770	519	350			169
Total	47,955	3,666	2,404	13	12	1,237
West Gulf:						
Arkansas	11,762	1,602	1,340		67	195
Louisiana	11,199	327	266		2	59
Oklahoma (East)	1,780	119	95	5	(4)	19
Texas (East)	7,247	712	678	2		32
Total	31,988	2,760	2,379	7	69	305
Total, South	113,701	8,857	6,744	45	81	1,987

See footnotes at end of table.

States and Coastal Alaska, by ownership class and section, region, and State, January 1, 1953 [1]

Growing stock—Continued		Live sawtimber							
State, county, and municipal [2]	Private	All ownerships	Federal ownership or trusteeship: Total	Federal: National forest	Federal: Indian [2]	Federal: Bureau of Land Management [2]	Federal: Other [2]	State, county, and municipal [2]	Private
Million cu. ft.	*Million cu. ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
136	1,167	1,859	1				1	158	1,700
132	12,385	28,226	189	110			79	297	27,740
231	1,629	2,659	14				14	235	2,410
76	3,624	10,069	1,672	1,661			11	120	8,277
12	149	165	(3)				(3)	20	145
91	3,620	8,547	556	539			17	179	7,812
678	22,574	51,525	2,432	2,310			122	1,009	48,084
12	451	1,234	2				2	34	1,198
168	2,679	6,771	108	8			100	399	6,264
90	861	1,660	1				1	156	1,503
981	10,624	26,883	107				107	2,043	24,733
1,451	8,913	19,306	481	445			36	2,635	16,190
55	7,140	18,497	1,258	1,238			20	130	17,109
2,757	30,668	74,351	1,957	1,691			266	5,397	66,997
1,560	7,169	21,141	2,226	2,100	13	6	107	2,400	16,515
2,283	3,183	12,538	3,012	2,433	489	24	66	3,078	6,448
1,082	5,673	16,111	2,952	1,119	1,643	5	185	1,551	11,608
4,925	16,025	49,790	8,190	5,652	2,145	35	358	7,029	34,571
8	2,895	11,694	564	468			96	30	11,100
80	2,865	11,671	330	153			177	222	11,119
13	1,160	4,119	34	1	2		31	49	4,036
39	7,268	27,342	1,931	1,420			511	156	25,255
59	4,896	13,195	1,319	1,212		1	106	141	11,735
133	3,823	14,650	187	187				445	14,018
332	22,907	82,671	4,365	3,441	2	1	921	1,043	77,263
	954	3,371	2				2		3,369
14	398	1,253	16	10	6			12	1,225
3	157	653	238		146	1	91	4	411
5	332	880						15	865
18	324	790	167	3	164			11	612
	223	730							730
40	2,388	7,677	423	13	316	1	93	42	7,212
8,732	94,562	266,014	17,367	13,107	2,463	37	1,760	14,520	234,127
128	12,638	44,152	3,123	2,566	80		477	473	40,556
95	8,890	32,299	1,930	1,400			530	278	30,091
95	9,481	30,407	2,752	2,292			460	344	27,311
318	31,009	106,858	7,805	6,258	80		1,467	1,095	97,958
84	11,137	38,211	1,793	1,512		14	267	250	36,168
137	7,205	23,032	2,121	1,344	12	14	751	383	20,528
88	11,559	36,920	3,965	1,577			2,388	275	32,680
365	8,463	25,789	3,036	2,607	21	8	400	963	21,790
167	5,084	15,350	1,665	1,170			495	426	13,259
841	43,448	139,302	12,580	8,210	33	36	4,301	2,297	124,425
59	10,101	38,317	5,513	4,655		220	638	194	32,610
138	10,734	41,436	1,096	871		7	218	515	39,825
22	1,639	5,580	468	380	20	(3)	68	77	5,035
6	6,529	25,575	2,925	2,842	4		79	24	22,626
225	29,003	110,908	10,002	8,748	24	227	1,003	810	100,096
1,384	103,460	357,068	30,387	23,216	137	263	6,771	4,202	322,479

TABLE 11.—*Net volume of growing stock and live sawtimber on commercial forest land in the United States*

Section, region, and State	Growing stock					
	All ownerships	Federal ownership or trusteeship				
		Total	National forest	Indian [2]	Bureau of Land Management [2]	Other [2]
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
West:						
Pacific Northwest:						
Douglas-fir subregion	113, 171	53, 753	41, 524	1, 357	10, 700	172
Pine subregion	33, 023	23, 142	18, 170	4, 409	532	31
Total	146, 194	76, 895	59, 694	5, 766	11, 232	203
Oregon	80, 973	49, 871	36, 825	2, 170	10, 876	
Washington	65, 221	27, 024	22, 869	3, 596	356	203
Total	146, 194	76, 895	59, 694	5, 766	11, 232	203
California	66, 711	33, 911	32, 086	656	1, 092	77
Northern Rocky Mountain:						
Idaho	21, 246	14, 813	14, 284	80	449	
Montana	16, 143	10, 863	9, 941	515	398	9
South Dakota (West)	1, 287	1, 011	1, 003		7	1
Wyoming	4, 087	3, 561	3, 150	161	250	
Total	42, 763	30, 248	28, 378	756	1, 104	10
Southern Rocky Mountain:						
Arizona	3, 700	3, 534	2, 727	805	2	
Colorado	8, 037	6, 903	6, 570	33	295	5
Nevada	151	38	38		[4]	
New Mexico	3, 683	2, 491	1, 990	421	50	30
Utah	2, 001	1, 780	1, 407	44	329	
Total	17, 572	14, 746	12, 732	1, 303	676	35
Total, West	273, 240	155, 800	132, 890	8, 481	14, 104	325
United States	498, 439	172, 861	145, 960	9, 669	14, 211	3, 021
Coastal Alaska	18, 496	18, 429	17, 139	13	1, 277	
All regions	516, 935	191, 290	163, 099	9, 682	15, 488	3, 021

[1] Net volume of live sawtimber in board-feet log scale, International ¼-inch rule, and of growing stock in cubic feet excluding bark. This table is similar in format to table 6 of Basic Forest Statistics for the United States, January 1945 (revised 1950 issue), but the data are not directly comparable because of changes in standards between 1945 and 1952.

[2] Because of different definitions of commercial forest land, different cruis-

and Coastal Alaska, by ownership class and section, region, and State, January 1, 1953 [1]—Continued

Growing stock—Continued		Live sawtimber							
			Federal ownership or trusteeship						
State, county, and municipal [2]	Private	All ownerships	Total	National forest	Indian [2]	Bureau of Land Management [2]	Other [2]	State, county, and municipal [2]	Private
Million cu. ft.	*Million cu. ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
6, 851	52, 567	594, 375	288, 403	221, 658	6, 759	59, 106	880	35, 100	270, 872
1, 068	8, 813	154, 501	110, 679	87, 249	20, 978	2, 359	93	4, 661	39, 161
7, 919	61, 380	748, 876	399, 082	308, 907	27, 737	61, 465	973	39, 761	310, 033
2, 512	28, 590	433, 809	266, 780	196, 278	10, 617	59, 885	----	13, 582	153, 447
5, 407	32, 790	315, 067	132, 302	112, 629	17, 120	1, 580	973	26, 179	156, 586
7, 919	61, 380	748, 876	399, 082	308, 907	27, 737	61, 465	973	39, 761	310, 033
861	31, 939	360, 001	189, 069	178, 913	3, 969	5, 817	370	4, 742	166, 190
1, 763	4, 670	96, 015	65, 505	63, 220	310	1, 975	----	8, 818	21, 692
709	4, 571	55, 770	36, 350	32, 954	2, 213	1, 162	21	2, 787	16, 633
66	210	3, 167	2, 657	2, 638	----	19	----	181	329
186	340	12, 070	10, 833	9, 420	628	757	28	169	1, 068
2, 724	9, 791	167, 022	115, 345	108, 232	3, 151	3, 913	49	11, 955	39, 722
26	140	19, 988	19, 151	14, 276	4, 864	11	----	116	721
134	1, 000	25, 394	23, 013	22, 032	192	782	7	302	2, 079
----	113	572	89	87	----	2	----	----	483
100	1, 092	15, 054	11, 201	8, 620	2, 254	226	101	350	3, 503
32	189	7, 800	7, 056	5, 461	139	1, 456	----	104	640
292	2, 534	68, 808	60, 510	50, 476	7, 449	2, 477	108	872	7, 426
11, 796	105, 644	1, 344, 707	764, 006	646, 528	42, 306	73, 672	1, 500	57, 330	523, 371
21, 912	303, 666	1, 967, 789	811, 760	682, 851	44, 906	73, 972	10, 031	76, 052	1, 079, 977
----	67	89, 058	88, 736	82, 524	61	6, 151	----	----	322
21, 912	303, 733	2, 056, 847	900, 496	765, 375	44, 967	80, 123	10, 031	76, 052	1, 080, 299

ing standards, specifications, and log rules adopted by the Forest Service and other public agencies, volume estimates for these ownerships may vary from actual published figures of the public agencies concerned.

[3] Less than 0.5 million board-feet.
[4] Less than 0.5 million cubic feet.

TABLE 12.—*Net annual growth of growing stock and live sawtimber on commercial forest land in the United States and Coastal Alaska, by softwoods and hardwoods, and by section, region, and State, 1952* [1]

Section, region, and State	Growing stock						Live sawtimber		
	Total		Softwood		Hardwood		Total	Softwood	Hardwood
	Million cu. ft.	*Million cords*	*Million cu. ft.*	*Million cords*	*Million cu. ft.*	*Million cords*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
North:									
New England:									
Connecticut	68	1.0	10	(2)	58	1.0	106	18	88
Maine	375	6.0	141	3.0	234	3.0	821	463	358
Massachusetts	80	(2)	25	(2)	55	(2)	139	68	71
New Hampshire	212	3.0	80	1.0	132	2.0	472	259	213
Rhode Island	9	(2)	1	(2)	8	(2)	9	2	7
Vermont	134	1.0	34	(2)	100	1.0	310	104	206
Total	878	11.0	291	4.0	587	7.0	1,857	914	943
Middle Atlantic:									
Delaware	18	(2)	7	(2)	11	(2)	56	19	37
Maryland	117	2.0	24	1.0	93	1.0	324	59	265
New Jersey	38	(2)	6	(2)	32	(2)	81	13	68
New York	393	5.0	66	1.0	327	4.0	1,041	214	827
Pennsylvania	357	4.0	26	(2)	331	4.0	750	93	657
West Virginia	434	6.0	27	(2)	407	6.0	908	72	836
Total	1,357	17.0	156	2.0	1,201	15.0	3,160	470	2,690
Lake States:									
Michigan	433	5.4	135	1.7	298	3.7	1,010	287	723
Minnesota	385	4.8	118	1.5	267	3.3	788	328	460
Wisconsin	362	4.5	66	.8	296	3.7	895	187	708
Total	1,180	14.7	319	4.0	861	10.7	2,693	802	1,891
Central:									
Illinois	135	2.1	1	(3)	134	2.1	496	2	494
Indiana	139	2.2	1	(3)	138	2.2	497	2	495
Iowa	49	.8	(4)	(3)	49	.8	219	---	219
Kentucky	365	5.6	28	.4	337	5.2	1,410	188	1,222
Missouri	270	4.2	12	.2	258	4.0	785	44	741
Ohio	170	2.7	4	.1	166	2.6	556	13	543
Total	1,128	17.6	46	.7	1,082	16.9	3,963	249	3,714
Plains:									
Kansas	39	.6	(4)	(3)	39	.6	178	(5)	178
Nebraska	19	.3	3	(3)	16	.3	66	10	56
North Dakota	9	.1	---	---	9	.1	28	---	28
Oklahoma (West)	16	.2	(4)	(3)	16	.2	43	(5)	43
South Dakota (East)	21	.3	1	(3)	20	.3	44	6	38
Texas (West)	12	.2	5	.1	7	.1	42	24	18
Total	116	1.7	9	.1	107	1.6	401	40	361
Total, North	4,659	62.0	821	10.8	3,838	51.2	12,074	2,475	9,599
South:									
South Atlantic:									
North Carolina	802	11.8	416	6.0	386	5.8	2,951	1,606	1,345
South Carolina	509	7.0	334	4.6	175	2.4	1,851	1,195	656
Virginia	597	8.9	219	3.3	378	5.6	2,078	869	1,209
Total	1,908	27.7	969	13.9	939	13.8	6,880	3,670	3,210
Southeast:									
Alabama	769	10.8	431	5.7	338	5.1	2,770	1,864	906
Florida	458	6.4	362	5.1	96	1.3	1,625	1,389	236
Georgia	869	12.6	590	8.6	279	4.0	3,174	2,370	804
Mississippi	716	10.2	279	3.7	437	6.5	1,628	887	741
Tennessee	244	3.6	52	.7	192	2.9	838	169	669
Total	3,056	43.6	1,714	23.8	1,342	19.8	10,035	6,679	3,356
West Gulf:									
Arkansas	573	8.2	268	3.6	305	4.6	2,253	1,220	1,033
Louisiana	687	9.8	292	3.9	395	5.9	2,691	1,445	1,246
Oklahoma (East)	97	1.4	36	.5	61	.9	286	145	141
Texas (East)	486	6.8	285	3.8	201	3.0	1,872	1,336	536
Total	1,843	26.2	881	11.8	962	14.4	7,102	4,146	2,956
Total, South	6,807	97.5	3,564	49.5	3,243	48.0	24,017	14,495	9,522

See footnotes at end of table.

TABLE 12.—*Net annual growth of growing stock and live sawtimber on commercial forest land in the United States and Coastal Alaska, by softwoods and hardwoods, and by section, region, and State, 1952* [1]—Continued

Section, region, and State	Growing stock						Live sawtimber		
	Total		Softwood		Hardwood		Total	Softwood	Hardwood
	Million cu. ft.	*Million cords*	*Million cu. ft.*	*Million cords*	*Million cu. ft.*	*Million cords*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
West:									
Pacific Northwest:									
Douglas-fir subregion	998	----	943	----	55	----	5,149	5,010	139
Pine subregion	329	----	329	----	----	----	828	824	4
Total	1,327	----	1,272	----	55	----	5,977	5,834	143
Oregon	686	----	658	----	28	----	3,560	3,481	79
Washington	641	----	614	----	27	----	2,417	2,353	64
Total	1,327	----	1,272	----	55	----	5,977	5,834	143
California	595	----	539	----	56	----	2,939	2,895	44
Northern Rocky Mountain:									
Idaho	354	----	352	----	2	----	1,139	1,135	4
Montana	172	----	164	----	8	----	247	229	18
South Dakota (West)	26	----	26	----	----	----	61	61	----
Wyoming	51	----	49	----	2	----	87	83	4
Total	603	----	591	----	12	----	1,534	1,508	26
Southern Rocky Mountain:									
Arizona	27	----	27	----	----	----	134	132	2
Colorado	110	----	96	----	14	----	241	224	17
Nevada	2	----	2	----	(4)	----	5	5	----
New Mexico	72	----	62	----	10	----	311	281	30
Utah	9	----	7	----	2	----	37	35	2
Total	220	----	194	----	26	----	728	677	51
Total, West	2,745	----	2,596	----	149	----	11,178	10,914	264
United States	14,211	----	6,981	----	7,230	----	47,269	27,884	19,385
Coastal Alaska	32	----	32	----	(4)	----	128	127	1
All regions	14,243	----	7,013	----	7,230	----	47,397	28,011	19,386

[1] Net growth of live sawtimber in board-feet log scale, International ¼-inch rule, and of growing stock in cubic feet excluding bark and in standard cords (128 cu. ft.) including bark. Equivalent net annual growth in cords not shown for the West and Coastal Alaska.

This table is similar in format to table 7 of Basic Forest Statistics for the United States, January 1945 (revised 1950 issue), but the data are not directly comparable because of changes in standards between 1945 and 1952.

[2] Less than 0.5 million cords.

[3] Less than 0.05 million cords.

[4] Less than 0.5 million cubic feet.

[5] Less than 0.5 million board-feet.

TABLE 13.—*Timber products output in the United States and Coastal Alaska, by selected products and softwoods and hardwoods, and by section, region, and State of origin, 1952* [1]

Section, region, and State	Saw logs (for lumber, etc.)			Pulpwood			Veneer logs and bolts			All other products		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
North:	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Number cords*	*Number cords*	*Number cords*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
New England:												
Connecticut	23, 373	7, 979	15, 394	6, 034	2, 954	3, 080	------	------	------	9, 578	726	8, 852
Maine	606, 485	504, 606	101, 879	1, 916, 388	1, 578, 344	338, 044	37, 787	------	37, 787	50, 815	29, 974	20, 841
Massachusetts	113, 036	83, 745	29, 291	18, 615	11, 095	7, 520	------	------	------	12, 069	2, 465	9, 604
New Hampshire	332, 670	293, 742	38, 928	249, 784	169, 612	80, 172	14, 055	------	14, 055	23, 523	11, 154	12, 369
Rhode Island	2, 505	157	2, 348	5, 000	2, 745	2, 255	------	------	------	1, 091	107	984
Vermont	269, 728	170, 258	99, 470	211, 721	178, 651	33, 070	14, 611	2	14, 609	23, 629	6, 924	16, 705
Total	1, 347, 797	1, 060, 487	287, 310	2, 407, 542	1, 943, 401	464, 141	66, 453	2	66, 451	120, 705	51, 350	69, 355
Middle Atlantic:												
Delaware	38, 322	30, 769	7, 553	35, 581	35, 581	------	3, 648	66	3, 582	4, 032	2, 033	1, 999
Maryland	229, 393	126, 137	103, 256	91, 700	74, 542	17, 158	9, 873	66	9, 807	30, 366	9, 198	21, 168
New Jersey	23, 899	4, 497	19, 402	86, 992	56, 551	30, 441	2, 033	656	1, 377	9, 114	2, 554	6, 560
New York	483, 926	198, 284	285, 642	411, 262	347, 494	63, 768	19, 118	------	19, 118	74, 549	14, 885	59, 664
Pennsylvania	428, 874	106, 307	322, 567	366, 836	78, 908	287, 928	4, 715	------	4, 715	91, 581	5, 018	86, 563
West Virginia	456, 729	30, 558	426, 171	87, 846	12, 093	75, 753	2, 446	------	2, 446	51, 588	95	51, 493
Total	1, 661, 143	496, 552	1, 164, 591	1, 080, 217	605, 169	475, 048	41, 833	788	41, 045	261, 230	33, 783	227, 447
Lake States:												
Michigan	482, 660	108, 650	374, 010	744, 628	455, 627	289, 001	36, 208	160	36, 048	144, 825	27, 159	117, 666
Minnesota	191, 250	98, 800	92, 450	921, 282	662, 367	258, 915	7, 256	7	7, 249	95, 796	27, 944	67, 852
Wisconsin	332, 100	82, 950	249, 150	565, 283	277, 350	287, 933	26, 980	172	26, 808	145, 332	17, 708	127, 624
Total	1, 006, 010	290, 400	715, 610	2, 231, 193	1, 395, 344	835, 849	70, 444	339	70, 105	385, 953	72, 811	313, 142
Central:												
Illinois	110, 000	660	109, 340	45, 000	------	45, 000	9, 280	------	9, 280	32, 056	------	32, 056
Indiana	190, 300	381	189, 919	12, 000	------	12, 000	10, 125	------	10, 125	32, 335	92	32, 243
Iowa	55, 000	1, 155	53, 845	1, 000	------	1, 000	4, 219	------	4, 219	18, 703	------	18, 703
Kentucky	522, 500	52, 250	470, 250	30, 000	2, 100	27, 900	10, 907	327	10, 580	129, 255	3, 321	125, 934
Missouri	200, 300	30, 245	170, 055	12, 000	3, 480	8, 520	8, 437	------	8, 437	90, 324	1, 842	88, 482
Ohio	249, 075	2, 717	246, 358	35, 000	------	35, 000	10, 125	------	10, 125	32, 932	1	32, 931
Total	1, 327, 175	87, 408	1, 239, 767	135, 000	5, 580	129, 420	53, 093	327	52, 766	335, 605	5, 256	330, 349
Plains:												
Kansas	17, 600	35	17, 565	------	------	------	2, 531	------	2, 531	9, 710	------	9, 710
Nebraska	4, 400	748	3, 652	------	------	------	1, 687	------	1, 687	4, 080	135	3, 945
North Dakota	2, 350	------	2, 350	------	------	------	------	------	------	4, 585	104	4, 481
Oklahoma (West)	6, 000	------	6, 000	------	------	------	261	------	261	23, 415	875	22, 540
South Dakota (East)	989	------	989	------	------	------	------	------	------	1, 491	727	764
Texas (West)	25, 000	10, 000	15, 000	7, 706	7, 706	------	782	------	782	72, 952	5, 652	67, 300
Total	56, 339	10, 783	45, 556	7, 706	7, 706	------	5, 261	------	5, 261	116, 233	7, 493	108, 740
Total, North	5, 398, 464	1, 945, 630	3, 452, 834	5, 861, 658	3, 957, 200	1, 904, 458	237, 084	1, 456	235, 628	1, 219, 726	170, 693	1, 049, 033
South:												
South Atlantic:												
North Carolina	2, 068, 598	1, 450, 294	618, 304	1, 366, 131	1, 119, 088	247, 043	98, 746	9, 419	89, 327	334, 028	178, 317	155, 711
South Carolina	1, 084, 001	805, 196	278, 805	1, 309, 326	1, 151, 245	158, 081	104, 643	3, 081	101, 562	156, 235	92, 730	63, 505
Virginia	1, 313, 228	749, 853	563, 375	1, 078, 167	855, 776	222, 391	35, 301	1, 562	33, 739	215, 545	99, 775	115, 770
Total	4, 465, 827	3, 005, 343	1, 460, 484	3, 753, 624	3, 126, 109	627, 515	238, 690	14, 062	224, 628	705, 808	370, 822	334, 986
Southeast:												
Alabama	1, 710, 000	1, 169, 000	541, 000	1, 608, 681	1, 583, 704	24, 977	60, 864	348	60, 516	196, 061	93, 132	102, 929
Florida	558, 533	525, 954	32, 579	1, 598, 210	1, 584, 952	13, 258	67, 917	8, 366	59, 551	66, 834	50, 265	16, 569
Georgia	2, 420, 533	1, 923, 113	497, 420	2, 534, 753	2, 413, 959	120, 794	111, 479	1, 597	109, 882	240, 894	149, 580	91, 314
Mississippi	1, 271, 000	719, 000	552, 000	1, 867, 266	1, 385, 005	482, 261	81, 558	8, 173	73, 385	268, 070	69, 302	198, 768
Tennessee	557, 000	173, 840	383, 160	268, 438	114, 514	153, 924	9, 569	206	9, 363	193, 526	28, 180	165, 346
Total	6, 517, 066	4, 510, 907	2, 006, 159	7, 877, 348	7, 082, 134	795, 214	331, 387	18, 690	312, 697	965, 385	390, 459	574, 926
West Gulf:												
Arkansas	985, 000	575, 000	410, 000	620, 156	533, 938	86, 218	44, 865	------	44, 865	199, 625	57, 781	141, 844
Louisiana	955, 000	511, 000	444, 000	1, 237, 264	1, 103, 976	133, 288	45, 126	1, 826	43, 300	197, 192	70, 922	126, 270
Oklahoma (East)	62, 000	43, 000	19, 000	34, 870	34, 870	------	348	------	348	38, 350	8, 095	30, 255
Texas (East)	1, 153, 000	965, 000	188, 000	1, 152, 212	1, 091, 690	60, 522	60, 690	3, 043	57, 647	130, 774	80, 835	49, 939
Total	3, 155, 000	2, 094, 000	1, 061, 000	3, 044, 502	2, 764, 474	280, 028	151, 029	4, 869	146, 160	565, 941	217, 633	348, 308
Total, South	14, 137, 893	9, 610, 250	4, 527, 643	14, 675, 474	12, 972, 717	1, 702, 757	721, 106	37, 621	683, 485	2, 237, 134	978, 914	1, 258, 220

See footnotes at end of table.

TABLE 13.—*Timber products output in the United States and Coastal Alaska, by selected products and softwoods and hardwoods, and by section, region, and State of origin, 1952* [1]—Continued

Section, region, and State	Saw logs (for lumber, etc.)			Pulpwood			Veneer logs and bolts			All other products		
	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
West:	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Number cords*	*Number cords*	*Number cords*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
Pacific Northwest:												
Douglas-fir subregion	10, 524, 368	10, 503, 169	21, 199	3, 875, 504	3, 827, 568	47, 936	1, 216, 791	1, 216, 791	----------	636, 411	635, 616	795
Pine subregion	1, 951, 628	1, 951, 628	----------	71, 537	71, 302	235	12, 963	12, 963	----------	127, 964	127, 964	----------
Total	12, 475, 996	12, 454, 797	21, 199	3, 947, 041	3, 898, 870	48, 171	1, 229, 754	1, 229, 754	----------	764, 375	763, 580	795
Oregon	8, 945, 000	8, 937, 192	7, 808	1, 357, 230	1, 348, 399	8, 831	948, 875	948, 875	----------	449, 592	449, 062	530
Washington	3, 530, 996	3, 517, 605	13, 391	2, 589, 811	2, 550, 471	39, 340	280, 879	280, 879	----------	314, 783	314, 518	265
Total	12, 475, 996	12, 454, 797	21, 199	3, 947, 041	3, 898, 870	48, 171	1, 229, 754	1, 229, 754	----------	764, 375	763, 580	795
California	4, 903, 011	4, 902, 411	600	269, 295	269, 243	52	270, 842	270, 842	----------	146, 446	141, 750	4, 696
Northern Rocky Mountain:												
Idaho	1, 155, 998	1, 155, 813	185	155, 575	153, 887	1, 688	8, 525	8, 525	----------	46, 043	45, 835	208
Montana	691, 001	691, 001	----------	139, 775	139, 775	----------	----------	----------	----------	23, 642	22, 410	1, 232
South Dakota (West)	39, 997	39, 997	----------	404	404	----------	----------	----------	----------	3, 378	3, 212	166
Wyoming	77, 999	77, 999	----------	1, 209	1, 209	----------	----------	----------	----------	3, 603	3, 447	156
Total	1, 964, 995	1, 964, 810	185	296, 963	295, 275	1, 688	8, 525	8, 525	----------	76, 666	74, 904	1, 762
Southern Rocky Mountain:												
Arizona	239, 997	239, 997	----------	----------	----------	----------	----------	----------	----------	27, 647	20, 726	6, 921
Colorado	169, 000	168, 860	140	14, 502	14, 502	----------	----------	----------	----------	15, 497	14, 422	1, 075
Nevada	1, 005	1, 005	----------	----------	----------	----------	----------	----------	----------	296	296	----------
New Mexico	110, 993	110, 993	----------	----------	----------	----------	----------	----------	----------	23, 416	17, 656	5, 760
Utah	35, 003	34, 478	525	----------	----------	----------	----------	----------	----------	3, 365	2, 875	490
Total	555, 998	555, 333	665	14, 502	14, 502	----------	----------	----------	----------	70, 221	55, 975	14, 246
Total, West	19, 900, 000	19, 877, 351	22, 649	4, 527, 801	4, 477, 890	49, 911	1, 509, 121	1, 509, 121	----------	1, 057, 708	1, 036, 209	21, 499
United States	39, 436, 357	31, 433, 231	8, 003, 126	25, 064, 933	21, 407, 807	3, 657, 126	2, 467, 311	1, 548, 198	919, 113	4, 514, 568	2, 185, 816	2, 328, 752
Coastal Alaska	73, 820	73, 820	----------	2, 846	2, 846	----------	25	25	----------	2, 996	2, 861	135
All regions	39, 510, 177	31, 507, 051	8, 003, 126	25, 067, 779	21, 410, 653	3, 657, 126	2, 467, 336	1, 548, 223	919, 113	4, 517, 564	2, 188, 677	2, 328, 887

[1] Estimates of timber products output include both roundwood and plant residues. The output from roundwood is according to States and regions where the logs, bolts, and other round timbers cut for various products originated, and not necessarily where they were processed into lumber, pulp, veneer, or other manufactured products or used in round form as poles, piling, posts, etc. The volume of plant residues such as used for fuelwood or chipped for pulp is, however, according to States and regions where used.

The output of fuelwood, although second to saw logs on a cubic-volume basis, is included with the "all other products" group because estimates are likely to be considerably in error for individual States. Other products including cooperage logs and bolts, poles and piling, posts, hewn ties, mine timbers, and various miscellaneous products like box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, etc., are grouped because their combined output represents only a comparatively small fraction of total timber products output.

Volumes are in units of measure commonly used by the Bureau of the Census, the trade, or other agencies reporting volume of output, i. e., saw logs for lumber, timbers, sawn ties, etc., in board-feet lumber tally, pulpwood in standard cords (128 cu. ft.) including bark, and veneer logs and bolts in board-feet log scale. Volumes for other products are shown in cubic feet excluding bark.

TABLE 14.—*Timber cut from live sawtimber on commercial forest land in the United States and Coastal*

Section, region, and State	All products			Saw logs (for lumber etc.)	
	Total	Softwood	Hardwood	Total	Softwood
	Thousand bd.-ft.	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*
North:					
New England:					
Connecticut	18, 902	6, 191	12, 711	18, 383	6, 137
Maine	1, 032, 312	860, 081	172, 231	490, 285	411, 534
Massachusetts	86, 157	61, 760	24, 397	81, 812	59, 256
New Hampshire	343, 338	274, 093	69, 245	253, 926	223, 787
Rhode Island	2, 210	131	2, 079	1, 963	118
Vermont	285, 537	178, 662	106, 875	212, 202	134, 905
Total	1, 768, 456	1, 380, 918	387, 538	1, 058, 571	835, 737
Middle Atlantic:					
Delaware	40, 374	28, 379	11, 995	24, 995	18, 855
Maryland	249, 063	119, 316	129, 747	182, 717	94, 474
New Jersey	33, 743	11, 098	22, 645	16, 927	2, 242
New York	630, 415	224, 936	405, 479	474, 200	168, 300
Pennsylvania	427, 769	99, 941	327, 828	343, 908	86, 947
West Virginia	413, 552	23, 861	389, 691	354, 056	22, 495
Total	1, 794, 916	507, 531	1, 287, 385	1, 396, 803	393, 313
Lake States:					
Michigan	594, 391	155, 837	438, 554	419, 110	93, 222
Minnesota	242, 392	124, 488	117, 904	150, 248	84, 771
Wisconsin	403, 624	103, 634	299, 990	272, 951	71, 174
Total	1, 240, 407	383, 959	856, 448	842, 309	249, 167
Central:					
Illinois	172, 959	594	172, 365	130, 069	594
Indiana	268, 801	346	268, 455	207, 614	346
Iowa	76, 219	1, 071	75, 148	55, 460	1, 071
Kentucky	694, 812	48, 958	645, 854	517, 280	46, 550
Missouri	315, 504	31, 988	283, 516	184, 434	26, 636
Ohio	280, 675	2, 499	278, 176	228, 901	2, 499
Total	1, 808, 970	85, 456	1, 723, 514	1, 323, 758	77, 696
Plains:					
Kansas	27, 742	33	27, 709	17, 775	33
Nebraska	10, 206	1, 448	8, 758	4, 383	694
North Dakota	4, 703	67	4, 636	2, 066	----
Oklahoma (West)	10, 686	44	10, 642	6, 087	----
South Dakota (East)	786	----	786	786	----
Texas (West)	39, 409	10, 647	28, 762	24, 944	9, 728
Total	93, 532	12, 239	81, 293	56, 041	10, 455
Total, North	6, 706, 281	2, 370, 103	4, 336, 178	4, 677, 482	1, 566, 368
South:					
South Atlantic:					
North Carolina	2, 381, 496	1, 541, 970	839, 526	1, 878, 136	1, 248, 703
South Carolina	1, 410, 637	952, 658	457, 979	977, 097	693, 274
Virginia	1, 560, 032	865, 305	694, 727	1, 219, 139	645, 623
Total	5, 352, 165	3, 359, 933	1, 992, 232	4, 074, 372	2, 587, 600
Southeast:					
Alabama	2, 377, 047	1, 497, 633	879, 414	1, 685, 899	1, 137, 135
Florida	930, 546	807, 643	122, 903	486, 011	452, 846
Georgia	2, 899, 327	2, 198, 796	700, 531	2, 162, 173	1, 655, 800
Mississippi	2, 211, 431	986, 159	1, 225, 272	1, 259, 323	699, 402
Tennessee	992, 835	233, 889	758, 946	557, 761	169, 100
Total	9, 411, 186	5, 724, 120	3, 687, 066	6, 151, 167	4, 114, 283
West Gulf:					
Arkansas	1, 551, 784	684, 512	867, 272	975, 211	559, 327
Louisiana	1, 595, 472	749, 438	846, 034	947, 443	497, 071
Oklahoma (East)	141, 549	52, 104	89, 445	61, 101	41, 828
Texas (East)	1, 546, 406	1, 150, 323	396, 083	1, 129, 394	938, 696
Total	4, 835, 211	2, 636, 377	2, 198, 834	3, 113, 149	2, 036, 922
Total, South	19, 598, 562	11, 720, 430	7, 878, 132	13, 338, 688	8, 738, 805

See footnote at end of table.

Alaska, by selected products and softwoods and hardwoods, and by section, region, and State of origin, 1952 [1]

Saw logs (for lumber etc.)—Continued	Pulpwood			Veneer logs and bolts			All other products		
Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
Thousand bd.-ft.	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*
12,246	35		35				484	54	430
78,751	493,679	443,982	49,697	39,226		39,226	9,122	4,565	4,557
22,556	3,487	2,106	1,381				858	398	460
30,139	60,636	42,118	18,518	14,940		14,940	13,836	8,188	5,648
1,845	141		141				106	13	93
77,297	49,208	42,944	6,264	15,388		15,388	8,739	813	7,926
222,834	607,186	531,150	76,036	69,554		69,554	33,145	14,031	19,114
6,140	5,382	5,382		3,736	80	3,656	6,261	4,062	2,199
88,243	13,717	11,276	2,441	10,124	81	10,043	42,505	13,485	29,020
14,685	9,729	7,692	2,037	2,167	712	1,455	4,920	452	4,468
305,900	68,848	54,765	14,083	20,652		20,652	66,715	1,871	64,844
256,961	48,606	12,994	35,612	5,072		5,072	30,183		30,183
331,561	13,677	1,347	12,330	2,531		2,531	43,288	19	43,269
1,003,490	159,959	93,456	66,503	44,282	873	43,409	193,872	19,889	173,983
325,888	56,511	46,113	10,398	41,861	190	41,671	76,909	16,312	60,597
65,477	35,149	25,833	9,316	8,375	8	8,367	48,620	13,876	34,744
201,777	36,180	25,738	10,442	31,179	205	30,974	63,314	6,517	56,797
593,142	127,840	97,684	30,156	81,415	403	81,012	188,843	36,705	152,138
129,475	637		637	13,205		13,205	29,048		29,048
207,268	47		47	14,405		14,405	46,735		46,735
54,389				5,555		5,555	15,204		15,204
470,730	778	128	650	14,102	390	13,712	162,652	1,890	160,762
157,798	2,035		2,035	10,395		10,395	118,640	5,352	113,288
226,402	1,307		1,307	12,572		12,572	37,895		37,895
1,246,062	4,804	128	4,676	70,234	390	69,844	410,174	7,242	402,932
17,742				3,333		3,333	6,634		6,634
3,689				2,222		2,222	3,601	754	2,847
2,066							2,637	67	2,570
6,087				436		436	4,163	44	4,119
786									
15,216	689	689		1,315		1,315	12,461	230	12,231
45,586	689	689		7,306		7,306	29,496	1,095	28,401
3,111,114	900,478	723,107	177,371	272,791	1,666	271,125	855,530	78,962	776,568
629,433	213,827	187,007	26,820	133,579	11,380	122,199	155,954	94,880	61,074
283,823	208,566	191,207	17,359	140,197	3,638	136,559	84,777	64,539	20,238
573,516	170.371	142,150	28,221	47,400	1,853	45,547	123,122	75,679	47,443
1,486,772	592,764	520,364	72,400	321,176	16,871	304,305	363,853	235,098	128,755
548,764	144,742	141,639	3,103	88,559	354	88,205	457,847	218,505	239,342
33,165	265,575	265,456	119	92,250	10,198	82,052	86,710	79,143	7,567
506,373	414,310	401,425	12,885	149,025	1,885	147,140	173,819	139,686	34,133
559,921	205,205	123,586	81,619	115,652	8,386	107,266	631,251	154,785	476,466
388,661	29,519	10,242	19,277	13,867	215	13,652	391,688	54,332	337,356
2,036,884	1,059,351	942,348	117,003	459,353	21,038	438,315	1,741,315	646,451	1,094,864
415,884	61,243	47,355	13,888	65,383		65,383	449,947	77,830	372,117
450,372	120,758	98,680	22,078	65,045	1,873	63,172	462,226	151,814	310,412
19,273	3,118	3,118		505		505	76,825	7,158	69,667
190,698	106,918	97,537	9,381	87,251	3,112	84,139	222,843	110,978	111,865
1,076,227	292,037	246,690	45,347	218,184	4,985	213,199	1,211,841	347,780	864,061
4,599,883	1,944,152	1,709,402	234,750	998,713	42,894	955,819	3,317,009	1,229,329	2,087,680

TABLE 14.—*Timber cut from live sawtimber on commercial forest land in the United States and Coastal Alaska, by*

Section, region, and State	All products			Saw logs (for lumber etc.)	
	Total	Softwood	Hardwood	Total	Softwood
	Thousand bd.-ft.	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*
West:					
Pacific Northwest:					
Douglas-fir subregion	12, 220, 815	12, 169, 523	51, 292	8, 989, 826	8, 971, 166
Pine subregion	2, 049, 861	2, 049, 718	143	1, 957, 740	1, 957, 740
Total	14, 270, 676	14, 219, 241	51, 435	10, 947, 566	10, 928, 906
Oregon	9, 808, 242	9, 790, 998	17, 244	8, 171, 549	8, 163, 091
Washington	4, 462, 434	4, 428, 243	34, 191	2, 776, 017	2, 765, 815
Total	14, 270, 676	14, 219, 241	51, 435	10, 947, 566	10, 928, 906
California	5, 724, 198	5, 704, 180	20, 018	5, 281, 982	5, 266, 878
Northern Rocky Mountain:					
Idaho	1, 124, 566	1, 123, 570	996	1, 054, 616	1, 054, 415
Montana	663, 734	662, 902	832	613, 851	613, 851
South Dakota (West)	40, 800	40, 574	226	37, 516	37, 516
Wyoming	69, 916	69, 777	139	64, 871	64, 871
Total	1, 899, 016	1, 896, 823	2, 193	1, 770, 854	1, 770, 653
Southern Rocky Mountain:					
Arizona	254, 725	254, 142	583	254, 142	254, 142
Colorado	145, 307	142, 210	3, 097	130, 745	130, 599
Nevada	1, 077	1, 077		1, 047	1, 047
New Mexico	114, 384	114, 384		114, 384	114, 384
Utah	39, 511	37, 180	2, 331	36, 384	35, 834
Total	555, 004	548, 993	6, 011	536, 702	536, 006
Total, West	22, 448, 894	22, 369, 237	79, 657	18, 537, 104	18, 502, 443
United States	48, 753, 737	36, 459, 770	12, 293, 967	36, 553, 274	28, 807, 616
Coastal Alaska	86, 092	86, 092		82, 924	82, 924
All regions	48, 839, 829	36, 545, 862	12, 293, 967	36, 636, 198	28, 890, 540

[1] Estimates of timber cut include logging residues as well as saw-log material removed as timber products. Timber cut for fuelwood, although third in volume next to pulpwood, is included in "all other products" because estimates are likely to be considerably in error for individual States. Other products, including cooperage logs and bolts, poles and piling, posts, hewn ties, mine timbers, and miscellaneous products like box and shingle

TABLE 15.—*Timber cut from growing stock on commercial forest land in the United States and Coastal*

Section, region, and State	All products			Saw logs (for lumber etc.)	
	Total	Softwood	Hardwood	Total	Softwood
	Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
North:					
New England:					
Connecticut	9, 010	1, 981	7, 029	4, 297	1, 413
Maine	284, 819	221, 687	63, 132	115, 997	95, 081
Massachusetts	25, 696	15, 542	10, 154	19, 593	14, 151
New Hampshire	98, 280	74, 517	23, 763	65, 136	56, 917
Rhode Island	1, 321	294	1, 027	440	28
Vermont	81, 092	47, 061	34, 031	51, 983	31, 810
Total	500, 218	361, 082	139, 136	257, 446	199, 400
Middle Atlantic:					
Delaware	11, 480	8, 646	2, 834	6, 308	4, 967
Maryland	64, 159	32, 744	31, 415	41, 423	23, 696
New Jersey	13, 356	5, 627	7, 729	3, 974	821
New York	140, 570	51, 301	89, 269	91, 941	33, 133
Pennsylvania	130, 886	24, 984	105, 902	73, 807	18, 523
West Virginia	108, 848	6, 202	102, 646	77, 503	5, 191
Total	469, 299	129, 504	339, 795	294, 956	86, 331
Lake States:					
Michigan	215, 510	67, 045	148, 465	92, 220	20, 808
Minnesota	148, 111	78, 511	69, 600	37, 775	18, 920
Wisconsin	173, 549	43, 010	130, 539	64, 687	15, 893
Total	537, 170	188, 566	348, 604	194, 682	55, 621
Central:					
Illinois	37, 955	92	37, 863	19, 809	92
Indiana	52, 076	145	51, 931	33, 285	53
Iowa	16, 970	165	16, 805	9, 396	165
Kentucky	161, 566	10, 134	151, 432	83, 001	7, 320
Missouri	83, 504	5, 969	77, 535	31, 916	4, 050
Ohio	53, 071	406	52, 665	37, 004	404
Total	405, 142	16, 911	388, 231	214, 411	12, 084

See footnote at end of table.

selected products and softwoods and hardwoods, and by section, region, and State of origin, 1952 [1]—Continued

Saw logs (for lumber etc.)—Continued	Pulpwood			Veneer logs and bolts			All other products		
Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
Thousand bd.-ft.	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*
18, 660	1, 695, 397	1, 667, 305	28, 092	1, 176, 240	1, 176, 240	-----	359, 352	354, 812	4, 540
-----	37, 923	37, 780	143	14, 368	14, 368	-----	39, 830	39, 830	-----
18, 660	1, 733, 320	1, 705, 085	28, 235	1, 190, 608	1, 190, 608	-----	399, 182	394, 642	4, 540
8, 458	531, 998	526, 497	5, 501	924, 005	924, 005	-----	180, 690	177, 405	3, 285
10, 202	1, 201, 322	1, 178, 588	22, 734	266, 603	266, 603	-----	218, 492	217, 237	1, 255
18, 660	1, 733, 320	1, 705, 085	28, 235	1, 190, 608	1, 190, 608	-----	399, 182	394, 642	4, 540
15, 104	53, 914	53, 574	340	332, 181	331, 659	522	56, 121	52, 069	4, 052
201	33, 191	32, 397	794	8, 797	8, 797	-----	27, 962	27, 961	1
-----	25, 748	25, 748	-----	-----	-----	-----	24, 135	23, 303	832
-----	132	132	-----	-----	-----	-----	3, 152	2, 926	226
-----	497	497	-----	-----	-----	-----	4, 548	4, 409	139
201	59, 568	58, 774	794	8, 797	8, 797	-----	59, 797	58, 599	1, 198
-----	-----	-----	-----	-----	-----	-----	583	-----	583
146	-----	-----	-----	-----	-----	-----	14, 562	11, 611	2, 951
-----	-----	-----	-----	-----	-----	-----	30	30	-----
-----	-----	-----	-----	-----	-----	-----			
550	-----	-----	-----	-----	-----	-----	3, 127	1, 346	1, 781
696	-----	-----	-----	-----	-----	-----	18, 302	12, 987	5, 315
34, 661	1, 846, 802	1, 817, 433	29, 369	1, 531, 586	1, 531, 064	522	533, 402	518, 297	15, 105
7, 745, 658	4, 691, 432	4, 249, 942	441, 490	2, 803, 090	1, 575, 624	1, 227, 466	4, 705, 941	1, 826, 588	2, 879, 353
-----	1, 833	1, 833	-----	31	31	-----	1, 304	1, 304	-----
7, 745, 658	4, 693, 265	4, 251, 775	441, 490	2, 803, 121	1, 575, 655	1, 227, 466	4, 707, 245	1, 827, 892	2, 879, 353

bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, etc., are grouped because their combined cut is only a comparatively small fraction of the total for all products. Volumes refer to live sawtimber inventory and are in net board-feet log scale, International ¼-inch rule.

Alaska, by selected products and softwoods and hardwoods, and by section, region, and State of origin, 1952 [1]

Saw logs (for lumber etc.)—Continued	Pulpwood			Veneer logs and bolts			All other products		
Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
2, 884	445	222	223	-----	-----	-----	4, 268	346	3, 922
20, 916	151, 170	124, 337	26, 833	7, 900	-----	7, 900	9, 752	2, 269	7, 483
5, 442	1, 356	829	527	-----	-----	-----	4, 747	562	4, 185
8, 219	19, 473	13, 600	5, 873	2, 907	-----	2, 907	10, 764	4, 000	6, 764
412	367	205	162	-----	-----	-----	514	61	453
20, 173	16, 607	14, 187	2, 420	2, 933	-----	2, 933	9, 569	1, 064	8, 505
58, 046	189, 418	153, 380	36, 038	13, 740	-----	13, 740	39, 614	8, 302	31, 312
1, 341	2, 509	2, 509	-----	732	13	719	1, 931	1, 157	774
17, 727	6, 541	5, 258	1, 283	1, 917	14	1, 903	14, 278	3, 776	10, 502
3, 153	6, 389	4, 091	2, 298	423	133	290	2, 570	582	1, 988
58, 808	22, 218	17, 225	4, 993	3, 970	-----	3, 970	22, 441	943	21, 498
55, 284	27, 601	6, 092	21, 509	957	-----	957	28, 521	369	28, 152
72, 312	7, 111	981	6, 130	530	-----	530	23, 704	30	23, 674
208, 625	72, 369	36, 156	36, 213	8, 529	160	8, 369	93, 445	6, 857	86, 588
71, 412	59, 719	35, 568	24, 151	7, 201	34	7, 167	56, 370	10, 635	45, 735
18, 855	73, 299	51, 665	21, 634	1, 438	1	1, 437	35, 599	7, 925	27, 674
48, 794	45, 863	21, 613	24, 250	5, 366	38	5, 328	57, 633	5, 466	52, 167
139, 061	178, 881	108, 846	70, 035	14, 005	73	13, 932	149, 602	24, 026	125, 576
19, 717	2, 567	-----	2, 567	2, 173	-----	2, 173	13, 406	-----	13, 406
33, 232	744	-----	744	2, 313	-----	2, 313	15, 734	92	15, 642
9, 231	62	-----	62	942	-----	942	6, 570	-----	6, 570
75, 681	1, 677	119	1, 558	2, 189	57	2, 132	74, 699	2, 638	72, 061
27, 866	584	202	382	1, 806	-----	1, 806	49, 198	1, 717	47, 481
36, 600	2, 170	1	2, 169	1, 972	-----	1, 972	11, 925	1	11, 924
202, 327	7, 804	322	7, 482	11, 395	57	11, 338	171, 532	4, 448	167, 084

TABLE 15.—*Timber cut from growing stock on commercial forest land in the United States and Coastal Alaska,*

Section, region, and State	All products			Saw logs (for lumber etc.)	
	Total	Softwood	Hardwood	Total	Softwood
North—Continued	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
Plains:					
Kansas	7,773	5	7,768	3,116	5
Nebraska	2,936	242	2,694	753	107
North Dakota	3,243	68	3,175	447	
Oklahoma (West)	2,911	170	2,741	1,314	
South Dakota (East)	154	19	135	135	
Texas (West)	11,087	3,456	7,631	5,147	1,863
Total	28,104	3,960	24,144	10,912	1,975
Total, North	1,939,933	700,023	1,239,910	972,407	355,411
South:					
South Atlantic:					
North Carolina	646,803	415,470	231,333	398,308	267,289
South Carolina	380,165	261,598	118,567	207,477	148,398
Virginia	427,980	238,788	189,192	257,577	138,198
Total	1,454,948	915,856	539,092	863,362	553,885
Southeast:					
Alabama	581,812	370,657	211,155	336,161	217,732
Florida	251,793	224,483	27,310	103,837	96,933
Georgia	749,662	573,051	176,611	459,833	354,430
Mississippi	569,748	257,544	312,204	254,753	133,917
Tennessee	252,444	53,418	199,026	116,256	32,379
Total	2,405,459	1,479,153	926,306	1,270,840	835,391
West Gulf:					
Arkansas	380,386	164,617	215,769	196,849	107,097
Louisiana	405,140	198,565	206,575	192,371	95,176
Oklahoma (East)	39,077	13,351	25,726	12,168	8,009
Texas (East)	368,243	274,568	93,675	220,891	179,736
Total	1,192,846	651,101	541,745	622,279	390,018
Total, South	5,053,253	3,046,110	2,007,143	2,756,481	1,779,294
West:					
Pacific Northwest:					
Douglas-fir subregion	2,031,275	2,022,525	8,750	1,495,973	1,492,797
Pine subregion	359,271	359,249	22	340,995	340,995
Total	2,390,546	2,381,774	8,772	1,836,968	1,833,792
Oregon	1,608,676	1,605,871	2,805	1,347,394	1,346,018
Washington	781,870	775,903	5,967	489,574	487,774
Total	2,390,546	2,381,774	8,772	1,836,968	1,833,792
California	931,536	920,389	11,147	862,611	853,295
Northern Rocky Mountain:					
Idaho	188,268	187,952	316	170,119	170,086
Montana	117,688	116,841	847	96,684	96,684
South Dakota (West)	8,506	8,454	52	7,131	7,131
Wyoming	14,631	14,589	42	12,705	12,705
Total	329,093	327,836	1,257	286,639	286,606
Southern Rocky Mountain:					
Arizona	41,676	41,416	260	41,313	41,313
Colorado	30,970	30,369	601	26,870	26,845
Nevada	221	221		186	186
New Mexico	18,674	18,674		18,593	18,593
Utah	8,499	7,907	592	6,498	6,401
Total	100,040	98,587	1,453	93,460	93,338
Total, West	3,751,215	3,728,586	22,629	3,079,678	3,067,031
United States	10,744,401	7,474,719	3,269,682	6,808,566	5,201,736
Coastal Alaska	12,372	12,372		11,887	11,887
All regions	10,756,773	7,487,091	3,269,682	6,820,453	5,213,623

[1] Estimates of timber cut refer to growing stock inventory and include logging residues as well as growing stock material removed as timber products. Timber cut for fuelwood, although third in volume next to pulpwood, is included in "all other products" because estimates are likely to be considerably in error for individual States. Other products, including cooperage logs and bolts, poles and piling, posts, hewn ties, mine timbers and miscellaneous products like box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, etc., are grouped because their combined cut is only a comparatively small fraction of the total for all products. Volumes are in net cubic feet roundwood excluding bark.

by selected products and softwoods and hardwoods, and by section, region, and State of origin, 1952 [1]—Continued

Saw logs (for lumber etc.)—Continued	Pulpwood			Veneer logs and bolts			All other products		
Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood
Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
3, 111				584		584	4, 073		4, 073
646				390		390	1, 793	135	1, 658
447							2, 796	68	2, 728
1, 314				80		80	1, 517	170	1, 347
135							19	19	
3, 284	497	497		240		240	5, 203	1, 096	4, 107
8, 937	497	497		1, 294		1, 294	15, 401	1, 488	13, 913
616, 996	448, 969	299, 201	149, 768	48, 963	290	48, 673	469, 594	45, 121	424, 473
131, 019	88, 692	74, 578	14, 114	28, 994	2, 629	26, 365	130, 809	70, 974	59, 835
59, 079	85, 388	76, 253	9, 135	30, 317	843	29, 474	56, 983	36, 104	20, 879
119, 379	71, 540	56, 689	14, 851	10, 259	430	9, 829	88, 604	43, 471	45, 133
309, 477	245, 620	207, 520	38, 100	69, 570	3, 902	65, 668	276, 396	150, 549	125, 847
118, 429	103, 518	102, 114	1, 404	16, 184	68	16, 116	125, 949	50, 743	75, 206
6, 904	105, 925	105, 863	62	20, 054	2, 354	17, 700	21, 977	19, 333	2, 644
105, 403	166, 866	160, 086	6, 780	32, 199	437	31, 762	90, 764	58, 098	32, 666
120, 836	126, 044	89, 099	36, 945	21, 185	1, 594	19, 591	167, 766	32, 934	134, 832
83, 877	16, 111	7, 385	8, 726	2, 534	41	2, 493	117, 543	13, 613	103, 930
435, 449	518, 464	464, 547	53, 917	92, 156	4, 494	87, 662	523, 999	174, 721	349, 278
89, 752	40, 428	34, 141	6, 287	11, 946		11, 946	131, 163	23, 379	107, 784
97, 195	81, 137	71, 143	9, 994	11, 896	356	11, 540	119, 736	31, 890	87, 846
4, 159	2, 248	2, 248		93		93	24, 568	3, 094	21, 474
41, 155	74, 565	70, 319	4, 246	15, 962	592	15, 370	56, 825	23, 921	32, 904
232, 261	198, 378	177, 851	20, 527	39, 897	948	38, 949	332, 292	82, 284	250, 008
977, 187	962, 462	849, 918	112, 544	201, 623	9, 344	192, 279	1, 132, 687	407, 554	725, 133
3, 176	281, 951	277, 236	4, 715	188, 958	188, 958		64, 393	63, 534	859
	6, 820	6, 798	22	2, 398	2, 398		9, 058	9, 058	
3, 176	288, 771	284, 034	4, 737	191, 356	191, 356		73, 451	72, 592	859
1, 376	84, 182	83, 317	865	145, 811	145, 811		31, 289	30, 725	564
1, 800	204, 589	200, 717	3, 872	45, 545	45, 545		42, 162	41, 867	295
3, 176	288, 771	284, 034	4, 737	191, 356	191, 356		73, 451	72, 592	859
9, 316	10, 199	9, 936	263	48, 194	47, 926	268	10, 532	9, 232	1, 300
33	5, 592	5, 463	129	1, 508	1, 508		11, 049	10, 895	154
	11, 111	11, 111					9, 893	9, 046	847
	34	34					1, 341	1, 289	52
	93	93					1, 833	1, 791	42
33	16, 830	16, 701	129	1, 508	1, 508		24, 116	23, 021	1, 095
							363	103	260
25							4, 100	3, 524	576
							35	35	
							81	81	
97							2, 001	1, 506	495
122							6, 580	5, 249	1, 331
12, 647	315, 800	310, 671	5, 129	241, 058	240, 790	268	114, 679	110, 094	4, 585
1, 606, 830	1, 727, 231	1, 459, 790	267, 441	491, 644	250, 424	241, 220	1, 716, 960	562, 769	1, 154, 191
	267	267		4	4		214	214	
1, 606, 830	1, 727, 498	1, 460, 057	267, 441	491, 648	250, 428	241, 220	1, 717, 174	562, 983	1, 154, 191

TABLE 16.—*Commercial and noncommercial forest land requiring protection from fire in the United States and*

Section, region, and State	All ownerships						Federal ownership or trusteeship					
	Total	Protected [2]				Unprotected	Total	Protected [2]				Unprotected
		Total	Class 1	Class 2	Class 3			Total	Class 1	Class 2	Class 3	
North:	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
New England:												
Connecticut	1, 990	100	100	(3)			1	100	100			
Maine	17, 088	100	(3)	100			115	100	44	56		
Massachusetts	3, 288	100	13	87			36	100	100			
New Hampshire	4, 848	100	56	44			669	100	98	2		
Rhode Island	434	100	8	90	2							
Vermont	3, 730	100	100				213	100	100			
Total	31, 378	100	28	72	(3)		1, 034	100	93	7		
Middle Atlantic:												
Delaware	454	100	57	43			1	100	100			
Maryland	2, 920	100	100				70	100	100			
New Jersey	1, 958	100	51	49			33	100		100		
New York	14, 450	100	45	47	8		125	100	2	98		
Pennsylvania	15, 205	100	100	(3)			501	100	100	(3)		
West Virginia	9, 907	100	38	11	51		900	100	83	17		
Total	44, 894	100	66	20	14		1, 630	100	81	19		
Lake States:												
Michigan	19, 322	100	72	25	3		2, 589	100	33	45	22	
Minnesota	19, 344	100	5	52	43		3, 086	100	32	54	14	
Wisconsin	16, 535	100	25	69	6	(3)	1, 888	100	24	69	7	(3)
Total	55, 201	100	34	48	18	(3)	7, 563	100	30	55	15	(3)
Central:												
Illinois	3, 993	100		19	81		241	100		60	40	
Indiana	4, 103	100		42	58		172	100		100		
Iowa	1, 990	100		49	51		22	100			100	
Kentucky	11, 497	57	7	22	28	43	723	100	7	93		
Missouri	15, 177	59	11	7	41	41	1, 352	100		78	22	(3)
Ohio	5, 067	100		66	34		94	100		43	57	
Total	41, 827	73	6	25	42	27	2, 604	100	2	80	18	(3)
Plains:												
Kansas	1, 668	100		(3)	100		1	100		100		
Nebraska	1, 480	100	2	1	97		37	100	82	18		
North Dakota	942	1	1			99	34	23		23		77
Oklahoma (West)	4, 302	16		(3)	16	84	850	43		1	42	57
South Dakota (East)	776	88	5	24	59	12	290	100	5	1	94	
Texas (West)	26, 000	1	(3)	(3)	1	99	1, 108	34	3	3	28	66
Total	35, 168	14	(3)	1	13	86	2, 320	46	3	3	40	54
Total, North	208, 468	80	29	33	18	20	15, 151	92	31	44	17	8
South:												
South Atlantic:												
North Carolina	19, 513	90	(3)	79	11	10	1, 710	100	2	87	11	(3)
South Carolina	11, 943	100	(3)	53	47		768	100	1	86	13	
Virginia	15, 832	100	3	97	(3)		1, 799	100	23	77	(3)	
Total	47, 288	96	1	78	17	4	4, 277	100	11	82	7	(3)
Southeast:												
Alabama	20, 771	100		33	67	(3)	794	99	(3)	89	10	1
Florida	23, 047	71		63	8	29	2, 053	97		88	9	3
Georgia	24, 057	80	2	76	2	20	1, 639	100		85	15	
Mississippi	16, 473	78		46	32	22	1, 264	99		90	9	1
Tennessee	12, 558	82	(3)	25	57	18	1, 085	100	3	88	9	
Total	96, 906	82	1	51	30	18	6, 835	99	1	88	10	1
West Gulf:												
Arkansas	19, 346	80	(3)	79	1	20	2, 840	97	(3)	91	6	3
Louisiana	15, 990	76	5	43	28	24	746	99		84	15	1
Oklahoma (East)	6, 027	66	(3)	32	34	34	283	96	3	67	26	4
Texas (East)	11, 708	78	(3)	63	15	22	738	99	3	89	7	1
Total	53, 071	77	2	59	16	23	4, 607	98	1	88	9	2
Total, South	197, 265	84	1	60	23	16	15, 719	99	4	86	9	1

See footnotes at end of table.

Coastal Alaska, and status of protection by ownership class and section, region, and State, 1952 [1]

State, county, and municipal						Private					
Total	Protected [2]				Unprotected	Total	Protected [2]				Unprotected
	Total	Class 1	Class 2	Class 3			Total	Class 1	Class 2	Class 3	
Thousand acres	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
170	100	100				1,819	100	100	(3)		
407	100		100			16,566	100		100		
391	100	100				2,861	100		100		
101	100	51	49			4,078	100	49	51		
30	100	67	33			404	100	4	94	2	
98	100	100				3,419	100	100			
1,197	100	61	39			29,147	100	25	75	(3)	
12	100	58	42			441	100	57	43		
164	100	100				2,686	100	100			
196	100	78	22			1,729	100	49	51		
3,176	100	78	22			11,149	100	37	53	10	
2,811	100	100				11,893	100	100			
123	100	45	37	18		8,884	100	34	10	56	
6,482	100	88	12	(3)		36,782	100	62	21	17	
4,194	100	94	6			12,539	100	72	28		
7,103	100		51	49		9,155	100		51	49	
2,414	100	25	75			12,233	100	25	68	7	
13,711	100	33	42	25		33,927	100	36	48	16	
47	100		100			3,705	100		15	85	
86	100		100			3,845	100		38	62	
13	100		100			1,955	100		50	50	
53	100	58	42			10,721	54	7	17	30	46
241	100	1		99		13,584	54	12		42	46
107	100		94	6		4,866	100		66	34	
547	100	6	49	45		38,676	71	6	21	44	29
						1,667	100			100	
24	100			100		1,419	100			100	
10					100	898					100
186	10			10	90	3,266	10			10	90
21	100	100				465	80		40	40	20
37	38			38	62	24,855					100
278	28	7		21	72	32,570	12		1	11	88
22,215	99	49	33	17	1	171,102	77	26	32	19	23
348	100		79	21		17,455	89		78	11	11
198	100		51	49		10,977	100		51	49	
100	100		100			13,933	100		100		
646	100		74	26		42,365	96		78	18	4
177	100		30	70		19,800	100		31	69	
560	86		43	43	14	20,434	68		61	7	32
126	100	2	76	22		22,292	79	3	75	1	21
482	81		47	34	19	14,727	77		43	34	23
345	100		25	75		11,128	80		19	61	20
1,690	90	(3)	42	48	10	88,381	81	1	49	31	19
120	100		72	28		16,386	77		77		23
187	100		74	26		15,057	74	5	41	28	26
99	100			100		5,645	64		31	33	36
35	100		66	34		10,935	77		62	15	23
441	100		56	44		48,023	75	3	56	16	25
2,777	94	(3)	52	42	6	178,769	83	1	58	24	17

TABLE 16.—*Commercial and noncommercial forest land requiring protection from fire in the United States*

Section, region, and State	All ownerships						Federal ownership or trusteeship					
	Total	Protected [2]				Unprotected	Total	Protected [2]				Unprotected
		Total	Class 1	Class 2	Class 3			Total	Class 1	Class 2	Class 3	
West:	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Pacific Northwest:												
Oregon	30, 261	100	1	96	3	----------	18, 087	100	1	98	1	----------
Washington	23, 870	100	1	95	4	----------	11, 580	100	(3)	97	3	----------
Total	54, 131	100	1	96	3	----------	29, 667	100	1	98	1	----------
California	52, 082	100	12	42	46	----------	24, 471	100	13	34	53	----------
Northern Rocky Mountain:												
Idaho	21, 025	100	19	73	8	----------	16, 339	100	18	75	7	----------
Montana	22, 330	100	15	69	16	----------	16, 457	100	13	77	10	----------
South Dakota (West)	1, 393	100	26	73	1	----------	1, 029	100	35	65	----------	----------
Wyoming	10, 513	99	25	51	23	1	9, 950	100	26	52	22	----------
Total	55, 261	100	19	67	14	(3)	43, 775	100	19	69	12	----------
Southern Rocky Mountain:												
Arizona	19, 212	92	3	52	37	8	15, 946	100	4	58	38	----------
Colorado	20, 834	88	50	34	4	12	15, 755	100	62	36	2	----------
Nevada	12, 036	99	30	62	7	1	11, 644	100	31	63	6	----------
New Mexico	21, 329	76	(3)	54	22	24	11, 944	100	1	86	13	----------
Utah	16, 219	100	33	56	11	----------	14, 610	100	34	57	9	----------
Total	89, 630	90	23	50	17	10	69, 899	100	28	58	14	----------
Total, West	251, 104	96	15	62	19	4	167, 812	100	18	65	17	----------
United States	656, 837	87	15	52	20	13	198, 682	99	18	65	16	1
Coastal Alaska	16, 508	100	5	81	14	----------	16, 446	100	5	81	14	----------
All regions	673, 345	88	15	53	20	12	215, 128	99	17	66	16	1

[1] The total forest land area requiring protection consists of 487, 710 thousand acres of commercial forest land exclusive of 520 thousand acres in Iowa and 379 thousand acres in Ohio not needing protection, and 175,585 thousand acres of noncommercial forest land. In addition, 9,541 thousand acres of nonforest land in California and 509 thousand acres in North Dakota are included for these States. Nonforest land requiring protection because of watershed values or because of adjacent timber or watershed values are not included for other States.

and Coastal Alaska, and status of protection by ownership class and section, region, and State, 1952 [1]—Continued

State, county, and municipal						Private					
Total	Protected [2]				Unprotected	Total	Protected [2]				Unprotected
	Total	Class 1	Class 2	Class 3			Total	Class 1	Class 2	Class 3	
Thousand acres	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1, 156	100		90	10		11, 018	100	2	93	5	
2, 225	100		96	4		10, 065	100	3	91	6	
3, 381	100		94	6		21, 083	100	2	92	6	
245	100	41	59			27, 366	100	11	49	40	
1, 080	100	25	69	6		3, 606	100	23	65	12	
739	100	19	71	10		5, 134	100	19	42	39	
18	100		100			346	100		95	5	
100	51	3	10	38	49	463	94	2	42	50	6
1, 937	97	21	67	9	3	9, 549	99	19	52	28	1
						3, 266	51		21	30	49
2, 614	27	1	21	5	73	2, 465	74	24	32	18	26
						392	80		52	28	20
						9, 385	47		15	32	53
354	100	15	57	28		1, 255	100	20	44	36	
2, 968	36	3	25	8	64	16, 763	56	5	21	30	44
8, 531	77	7	63	7	23	74, 761	90	8	56	26	10
33, 523	93	34	42	17	7	424, 632	81	12	47	22	19
						62	100	8	84	8	
33, 523	93	34	42	17	7	424, 694	81	12	47	22	19

[2] Class of protection: Class 1, protection adequate to meet the fire situation in worst years and under serious peak load conditions; Class 2, protection adequate to meet the average fire situation but failures likely in the worst years and under peak load conditions; Class 3, protection adequate to meet fire situation in the easy years and failures frequent in average or worse years.

[3] Less than 0.5 percent.

TABLE 17.—*Annual mortality of live sawtimber and growing stock on commercial forest land in the United States and Coastal Alaska, by cause; section, region, and State; and softwoods and hardwoods, 1952* [1]

Section, region, and State	Growing stock							Live sawtimber						
	Total	Softwood	Hardwood	Mortality cause				Total	Softwood	Hardwood	Mortality cause			
				Fire	Insects	Disease	Other [2]				Fire	Insects	Disease	Other [2]
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
North:														
New England:														
Connecticut	7	1	6	2	(3)	1	4	4	1	3	2	(4)	2	(4)
Maine	196	48	148	1	10	154	31	402	127	275	3	30	303	66
Massachusetts	20	11	9	1	6	8	5	30	26	4	(4)	3	21	6
New Hampshire	52	29	23	(3)	5	42	5	140	84	56	1	12	117	10
Rhode Island	1	(3)	1	(3)	-------	(3)	1	2	1	1	1	-------	(4)	1
Vermont	22	10	12	(3)	2	13	7	67	29	38	(4)	8	32	27
Total	298	99	199	4	23	218	53	645	268	377	7	53	475	110
Middle Atlantic:														
Delaware	4	2	2	(3)	-------	(3)	4	4	3	1	(4)	-------	(4)	4
Maryland	16	9	7	1	(3)	1	14	21	10	11	2	1	4	14
New Jersey	5	3	2	(3)	(3)	2	3	6	2	4	1	(4)	1	4
New York	104	34	70	4	3	21	76	147	61	86	4	10	63	70
Pennsylvania	85	15	70	2	4	12	67	103	36	67	1	8	30	64
West Virginia	19	1	18	1	1	3	14	73	3	70	2	5	9	57
Total	233	64	169	8	8	39	178	354	115	239	10	24	107	213
Lake States:														
Michigan	136	24	112	1	13	43	79	278	61	217	1	7	63	207
Minnesota	173	68	105	1	14	69	89	194	88	106	2	11	68	113
Wisconsin	176	30	146	(3)	7	54	115	226	60	166	(4)	2	62	162
Total	485	122	363	2	34	166	283	698	209	489	3	20	193	482
Central:														
Illinois	15	(3)	15	1	-------	5	9	59	(4)	59	2	-------	19	38
Indiana	7	(3)	7	1	-------	2	4	19	(4)	19	2	-------	8	9
Iowa	12	(3)	12	1	-------	4	7	40	-------	40	4	-------	18	18
Kentucky	30	2	28	6	-------	9	15	90	7	83	13	-------	27	50
Missouri	30	2	28	11	-------	6	13	79	5	74	23	-------	28	28
Ohio	8	(3)	8	1	-------	3	4	25	1	24	2	-------	11	12
Total	102	4	98	21	-------	29	52	312	13	299	46	-------	111	155
Plains:														
Kansas	9	(3)	9	1	-------	3	5	32	(4)	32	3	-------	14	15
Nebraska	5	1	4	(3)	-------	1	4	12	2	10	1	-------	6	5
North Dakota	5	(3)	5	(3)	(3)	3	2	10	(4)	10	(4)	1	5	4
Oklahoma (West)	2	-------	2	(3)	(3)	(3)	2	5	-------	5	1	(4)	(4)	4
South Dakota (East)	5	(3)	5	(3)	(3)	2	3	7	1	6	-------	-------	3	4
Texas (West)	2	1	1	(3)	(3)	(3)	2	4	2	2	(4)	1	(4)	3
Total	28	2	26	1	(3)	9	18	70	5	65	5	2	28	35
Total, North	1,146	291	855	36	65	461	584	2,079	610	1,469	71	99	914	995
South:														
South Atlantic:														
North Carolina	35	23	12	6	9	7	13	98	68	30	17	26	25	30
South Carolina	39	30	9	6	10	8	15	127	101	26	23	37	32	35
Virginia	21	11	10	4	4	5	8	42	22	20	7	9	11	15
Total	95	64	31	16	23	20	36	267	191	76	47	72	68	80
Southeast:														
Alabama	82	39	43	10	13	12	47	229	131	98	19	56	32	122
Florida	40	30	10	11	5	7	17	117	88	29	22	22	23	50
Georgia	80	51	29	23	11	15	31	242	152	90	66	38	51	87
Mississippi	70	23	47	14	10	4	42	159	68	91	25	32	11	91
Tennessee	42	6	36	13	3	2	24	94	16	78	22	8	7	57
Total	314	149	165	71	42	40	161	841	455	386	154	156	124	407
West Gulf:														
Arkansas	82	29	53	16	13	5	48	226	104	122	36	48	15	127
Louisiana	76	26	50	14	15	5	42	248	109	139	40	61	19	128
Oklahoma (East)	12	4	8	2	2	1	7	33	13	20	3	9	2	19
Texas (East)	50	26	24	7	17	2	24	153	100	53	14	66	5	68
Total	220	85	135	39	47	13	121	660	326	334	93	184	41	342
Total, South	629	298	331	126	112	73	318	1,768	972	796	294	412	233	829

See footnotes at end of table.

TABLE 17.—*Annual mortality of live sawtimber and growing stock on commercial forest land in the United States and Coastal Alaska, by cause; section, region, and State; and softwoods and hardwoods, 1952* [1]—Continued

Section, region, and State	Growing stock							Live sawtimber						
	Total	Softwood	Hardwood	Mortality cause				Total	Softwood	Hardwood	Mortality cause			
				Fire	Insects	Disease	Other [2]				Fire	Insects	Disease	Other [2]
West:	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Pacific Northwest:														
Douglas-fir subregion	551	537	14	34	225	62	230	3, 105	3, 056	49	189	1, 313	369	1, 234
Pine subregion	196	196			89	16	91	932	932		4	422	75	431
Total	747	733	14	34	314	78	321	4, 037	3, 988	49	193	1, 735	444	1, 665
Oregon	393	386	7	23	170	40	160	2, 314	2, 287	27	129	1, 037	253	895
Washington	354	347	7	11	144	38	161	1, 723	1, 701	22	64	698	191	770
Total	747	733	14	34	314	78	321	4, 037	3, 988	49	193	1, 735	444	1, 665
California	359	336	23	21	228	45	65	1, 865	1, 811	54	131	1, 358	204	172
Northern Rocky Mountain:														
Idaho	153	153	(3)	5	77	30	41	714	713	1	20	399	95	200
Montana	123	122	1	2	75	6	40	630	630	(4)	7	408	30	185
South Dakota (West)	4	4		(3)	1	(3)	3	15	15	(4)	(4)	3	(4)	12
Wyoming	28	27	1	(3)	5	(3)	23	116	114	2	(4)	23	9	84
Total	308	306	2	7	158	36	107	1, 475	1, 472	3	27	833	134	481
Southern Rocky Mountain:														
Arizona	46	44	2	4	13	8	21	240	234	6	24	63	39	114
Colorado	73	67	6	(3)	27	5	41	275	266	9	2	121	24	128
Nevada	1	1	(3)	(3)	1	(3)	(3)	5	5	(4)	1	3	(4)	1
New Mexico	68	57	11	7	18	14	29	334	298	36	35	84	67	148
Utah	12	10	2	(3)	7	4	1	52	46	6	1	27	16	8
Total	200	179	21	11	66	31	92	906	849	57	63	298	146	399
Total, West	1, 614	1, 554	60	73	766	190	585	8, 283	8, 120	163	414	4, 224	928	2, 717
United States	3, 389	2, 143	1, 246	235	943	724	1, 487	12, 130	9, 702	2, 428	779	4, 735	2, 075	4, 541
Coastal Alaska	100	100	(3)	1	27	49	23	392	392	(4)	2	98	204	88
All regions	3, 489	2, 243	1, 246	236	970	773	1, 510	12, 522	10, 094	2, 428	781	4, 833	2, 279	4, 629

[1] Mortality of live sawtimber in board-feet log scale, International ¼-inch rule, and growing stock is in cubic feet excluding bark. Estimates represent the current level of mortality indicated by trends over a long period of years as determined in 1952.

[2] Weather, animals, suppression, etc.
[3] Less than 0.5 million cubic feet.
[4] Less than 0.5 million board-feet.

TABLE 18.—*Area of acceptable plantations on commercial and noncommercial forest land and area of*

Section, region, and State	Total, all land	Commercial forest land								
		Total	Federal ownership or trusteeship					State	County and municipal	Private
			Total	National forest	Bureau of Land Management	Indian	Other			
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
North:										
New England:										
Connecticut	30.0	30.0						9.0	3.0	18.0
Maine	17.2	17.2	0.1	0.1				.4	.6	16.1
Massachusetts	50.0	50.0	.7				0.7	30.0	8.3	11.0
New Hampshire	20.6	20.6	1.0	1.0				4.8	2.6	12.2
Rhode Island	12.0	12.0						1.0	6.0	5.0
Vermont	29.7	29.7	1.4	1.4				3.2	3.3	21.8
Total	159.5	159.5	3.2	2.5			.7	48.4	23.8	84.1
Middle Atlantic:										
Delaware	.7	.7	(2)				(2)	.2	.1	.4
Maryland	17.3	17.3						1.7	1.4	14.2
New Jersey	18.0	18.0						5.0	.7	12.3
New York	575.0	532.0						285.0	68.0	179.0
Pennsylvania	185.0	185.0	12.2	12.2				50.0	8.0	114.8
West Virginia	26.9	26.9	14.7	14.7				1.2	.2	10.8
Total	822.9	779.9	26.9	26.9			(2)	343.1	78.4	331.5
Lake States:										
Michigan	761.0	751.2	380.2	376.0		0.2	4.0	268.0	10.0	93.0
Minnesota	212.2	200.0	100.7	96.0		4.0	.7	33.4	3.9	62.0
Wisconsin	450.4	440.1	171.1	166.0		1.8	3.3	37.0	111.0	121.0
Total	1,423.6	1,391.3	652.0	638.0		6.0	8.0	338.4	124.9	276.0
Central:										
Illinois	83.7	75.9	32.5	30.5			2.0	6.6		36.8
Indiana	71.8	61.3	13.6	11.4			2.2	11.8		35.9
Iowa	45.8	14.0	(2)			(2)		2.4		11.6
Kentucky	12.1	12.1	.4	.4				1.0	.1	10.6
Missouri	58.1	56.2	45.8	45.7			.1	2.3		8.1
Ohio	70.2	63.1	9.0	7.0			2.0	11.9	7.2	35.0
Total	341.7	282.6	101.3	95.0		(2)	6.3	36.0	7.3	138.0
Plains:										
Kansas	152.6	17.0						2.0		15.0
Nebraska	216.8	21.0	16.0	16.0						5.0
North Dakota	66.7	.8								.8
Oklahoma (West)	22.4	7.0								7.0
South Dakota (East)	67.5	10.0								10.0
Texas (West)	25.1									
Total	551.1	55.8	16.0	16.0				2.0		37.8
Total, North	3,298.8	2,669.1	799.4	778.4		6.0	15.0	767.9	234.4	867.4
South:										
South Atlantic:										
North Carolina	80.9	80.9	12.6	5.9		.1	6.6	2.8	.7	64.8
South Carolina	186.4	186.4	27.9	15.8			12.1	11.8	1.0	145.7
Virginia	33.1	33.1	1.1	1.1				2.5	.7	28.8
Total	300.4	300.4	41.6	22.8		.1	18.7	17.1	2.4	239.3
Southeast:										
Alabama	156.8	156.8	57.9	36.3			21.6	2.7	.2	96.0
Florida	227.0	227.0	21.8	9.0			12.8	4.0	.6	200.6
Georgia	344.4	344.4	8.5	3.4			5.1	3.7	2.0	330.2
Mississippi	256.3	256.3	134.6	129.2			5.4	2.2	.2	119.3
Tennessee	197.0	197.0	47.6	3.3			44.3	20.4	.6	128.4
Total	1,181.5	1,181.5	270.4	181.2			89.2	33.0	3.6	874.5
West Gulf:										
Arkansas	76.6	76.6	13.4	9.6			3.8	.1	.4	62.7
Louisiana	291.1	291.1	80.3	76.9			3.4	3.9	2.1	204.8
Oklahoma (East)	6.9	6.9	3.6				3.6	.3	(2)	3.0
Texas (East)	120.2	120.2	37.3	36.5			.8	.8	1.9	80.2
Total	494.8	494.8	134.6	123.0			11.6	5.1	4.4	350.7
Total, South	1,976.7	1,976.7	446.6	327.0		.1	119.5	55.2	10.4	1,464.5

See footnotes at end of table.

shelterbelts in continental United States, by ownership class and section, region, and State, June 30, 1952 [1]

Noncommercial forest land									Shelterbelts							
Total	Federal ownership or trusteeship					State	County and municipal	Private	Total	Federal ownership or trusteeship			State	County and municipal	Private
	Total	National forest	Bureau of Land Management	Indian	Other					Total	Indian	Other			
Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
43.0						38.0	5.0								
43.0						38.0	5.0								
4.8	3.8				3.8			1.0	5.0						5.0
.7	.7				.7				11.5						11.5
4.3	3.3				3.3			1.0	6.0						6.0
9.8	7.8				7.8			2.0	22.5						22.5
6.0	3.2				3.2		1.8	1.0	1.8						1.8
2.5	2.1				2.1		.4		8.0						8.0
6.8						2.5	.3	4.0	25.0						25.0
.9	.2				.2		(2)	.7	1.0						1.0
5.9	1.9				1.9		1.0	3.0	1.2						1.2
22.1	7.4				7.4	2.5	3.5	8.7	37.0						37.0
3.6	.1				.1			3.5	132.0				0.3	0.2	131.5
7.8	.1				.1	.3	.4	7.0	188.0						188.0
.8								.8	65.1	1.4	0.1	1.3	.3	(2)	63.4
									15.4						15.4
.7						.7			56.8	1.0	1.0	(2)		.8	55.0
									25.1						25.1
12.9	.2				.2	1.0	.4	11.3	482.4	2.4	1.1	1.3	.6	1.0	478.4
87.8	15.4				15.4	41.5	8.9	22.0	541.9	2.4	1.1	1.3	.6	1.0	537.9

TABLE 18.—*Area of acceptable plantations on commercial and noncommercial forest land and area of shelterbelts*

Section, region, and State	Total, all land	Commercial forest land								
		Total	Federal ownership or trusteeship					State	County and municipal	Private
			Total	National forest	Bureau of Land Management	Indian	Other			
West:	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Pacific Northwest:										
Oregon	174.8	174.7	76.1	61.6	14.4	----	.1	45.5	.3	52.8
Washington	202.3	201.7	88.2	82.5	----	5.4	.3	30.6	5.0	77.9
Total	377.1	376.4	164.3	144.1	14.4	5.4	.4	76.1	5.3	130.7
California	36.0	26.0	17.0	16.9	----	(2)	.1	----	----	9.0
Northern Rocky Mountain:										
Idaho	82.4	76.7	76.1	76.0	----	(2)	.1	.5	.1	(2)
Montana	30.6	22.6	22.3	21.9	----	----	.4	----	(2)	.3
South Dakota (West)	16.7	12.7	12.6	12.6	----	----	----	.1	----	----
Wyoming	13.0	2.7	2.7	2.7	(2)	----	----	----	----	----
Total	142.7	114.7	113.7	113.2	(2)	(2)	.5	.6	.1	.3
Southern Rocky Mountain:										
Arizona	4.6	4.1	3.2	.3	----	.1	2.8	----	----	.9
Colorado	48.7	37.4	37.4	37.4	----	----	----	----	----	----
Nevada	.1	(2)	(2)	(2)	----	----	----	----	----	----
New Mexico	6.3	4.1	2.9	.4	----	.3	2.2	----	----	1.2
Utah	3.9	1.6	1.6	1.6	----	----	(2)	----	----	(2)
Total	63.6	47.2	45.1	39.7	----	.4	5.0	----	----	2.1
Total, West	619.4	564.3	340.1	313.9	14.4	5.8	6.0	76.7	5.4	142.1
Continental United States	5,894.9	5,210.1	1,586.1	1,419.3	14.4	11.9	140.5	899.8	250.2	2,474.0

[1] To qualify as acceptable, plantations must have at the end of the fifth year after planting the following number of planted trees per plantation acre: Engelmann spruce and lodgepole pine, 300; other western species, 200; all eastern species, 400.

[2] Less than 0.05 thousand acres.

TABLE 19.—*Plantable area and plantable noncommercial forest land and needed shelterbelt plantings*

Section, region, and State	Total, all land	Commercial forest land								
		Total	Federal ownership or trusteeship					State	County and municipal	Private
			Total	National forest	Bureau of Land Management	Indian	Other			
North:	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
New England:										
Connecticut	205	205	----	----	----	----	----	35	----	170
Maine	476	474	2	----	----	----	2	----	12	460
Massachusetts	115	100	1	----	----	----	1	12	3	84
New Hampshire	310	310	1	----	----	----	1	4	22	283
Rhode Island	39	38	----	----	----	----	----	4	----	34
Vermont	101	101	2	2	----	----	----	1	1	97
Total	1,246	1,228	6	2	----	----	4	56	38	1,128
Middle Atlantic:										
Delaware	34	34	----	----	----	----	----	2	----	32
Maryland	250	250	----	----	----	----	----	3	5	242
New Jersey	93	91	----	----	----	----	----	1	1	89
New York	1,250	1,250	----	----	----	----	----	30	5	1,215
Pennsylvania	1,100	1,100	20	20	----	----	----	20	5	1,055
West Virginia	1,000	1,000	11	11	----	----	----	10	----	979
Total	3,727	3,725	31	31	----	----	----	66	16	3,612
Lake States:										
Michigan	3,176	2,870	246	245	----	1	----	250	50	2,324
Minnesota	2,521	2,261	111	96	----	15	----	200	400	1,550
Wisconsin	2,790	2,520	80	63	----	4	13	63	347	2,030
Total	8,487	7,651	437	404	----	20	13	513	797	5,904

See footnotes at end of table.

in continental United States, by ownership class and section, region, and State, June 30, 1952 [1]—Continued

Noncommercial forest land									Shelterbelts						
Total	Federal ownership or trusteeship: Total	Federal ownership or trusteeship: National forest	Federal ownership or trusteeship: Bureau of Land Management	Federal ownership or trusteeship: Indian	Federal ownership or trusteeship: Other	State	County and municipal	Private	Total	Federal ownership or trusteeship: Total	Federal ownership or trusteeship: Indian	Federal ownership or trusteeship: Other	State	County and municipal	Private
Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
									.1						.1
									.6						.6
									.7						.7
5.0	(2)	(2)						5.0	5.0						5.0
									5.7						5.7
									8.0						8.0
									4.0						4.0
(2)								(2)	10.3	.3	.1	.2	.1	(2)	9.9
(2)								(2)	28.0	.3	.1	.2	.1	(2)	27.6
									.5	(2)		(2)			.5
2.3	.7	(2)	.3	.3	.1	(2)		1.6	9.0					(2)	9.0
									.1						.1
									2.2	(2)		(2)			2.2
.3								.3	2.0	(2)	(2)		(2)	(2)	2.0
2.6	.7	(2)	.3	.3	.1	(2)		1.9	13.8	(2)	(2)	(2)	(2)	(2)	13.8
7.6	.7	(2)	.3	.3	.1	(2)		6.9	47.5	.3	.1	.2	.1	(2)	47.1
95.4	16.1	(2)	.3	.3	15.5	41.5	8.9	28.9	589.4	2.7	1.2	1.5	.7	1.0	585.0

in continental United States, by ownership class and section, region, and State, January 1, 1953 [1]

Noncommercial forest land									Shelterbelts					
Total	Federal ownership or trusteeship: Total	Federal ownership or trusteeship: National forest	Federal ownership or trusteeship: Bureau of Land Management	Federal ownership or trusteeship: Indian	Federal ownership or trusteeship: Other	State	County and municipal	Private	Total	Federal ownership or trusteeship: Total	Federal ownership or trusteeship: Indian	Federal ownership or trusteeship: Other	County and municipal	Private
Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
2	2				2									
15						1		14						
1						1								
18	2				2	2		14						
2						1		1						
2						1		1						
256	25	25				35	30	166	50					50
160						30	30	100	100					100
220	25	25				35	30	130	50					50
636	50	50				100	90	396	200					200

TABLE 19.—*Plantable area and plantable noncommercial forest land and needed shelterbelt plantings in*

Section, region, and State	Total, all land	Commercial forest land								
		Total	Federal ownership or trusteeship					State	County and munici-pal	Private
			Total	National forest	Bureau of Land Manage-ment	Indian	Other			
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
North—Continued										
Central:										
Illinois	2,893	2,791	32	29			3	8	1	2,750
Indiana	1,345	1,282	55	43			12	25	2	1,200
Iowa	613	426						1	1	424
Kentucky	1,500	1,500						4	1	1,495
Missouri	1,305	1,240	38	37			1	2		1,200
Ohio	739	630	10	10				10	10	600
Total	8,395	7,869	135	119			16	50	15	7,669
Plains:										
Kansas	915	350						15	10	325
Nebraska	982	224	14	14				8	2	200
North Dakota	742	58								58
Oklahoma (West)	471	180								180
South Dakota (East)	599	138	8				8			130
Texas (West)	51	25							1	24
Total	3,760	975	22	14			8	23	13	917
Total, North	25,615	21,448	631	570		20	41	708	879	19,230
South:										
South Atlantic:										
North Carolina	970	970	72	58		1	13	40	5	853
South Carolina	1,311	1,311	142	9			133	63		1,106
Virginia	1,800	1,800	1	1				10		1,789
Total	4,081	4,081	215	68		1	146	113	5	3,748
Southeast:										
Alabama	1,734	1,734	59	46			13	45		1,630
Florida	5,070	5,070	211	110		1	100	22	5	4,832
Georgia	1,574	1,574	8	3			5	3		1,563
Mississippi	4,343	4,343	156	101	4	2	49	24	127	4,036
Tennessee	1,493	1,493	28	3			25	25		1,440
Total	14,214	14,214	462	263	4	3	192	119	132	13,501
West Gulf:										
Arkansas	1,515	1,515	107	73	3		31		3	1,405
Louisiana	1,224	1,224	85	70			15		25	1,114
Oklahoma (East)	413	413	8	1		5	2			405
Texas (East)	500	500	12	2			10	2	1	485
Total	3,652	3,652	212	146	3	5	58	2	29	3,409
Total, South	21,947	21,947	889	477	7	9	396	234	166	20,658
West:										
Pacific Northwest:										
Oregon	1,777	1,538	588	393	169	8	18	181	75	694
Washington	1,055	930	197	151		32	14	168	70	495
Total	2,832	2,468	785	544	169	40	32	349	145	1,189
California	7,211	4,104	1,987	1,844		29	114	37	2	2,078
Northern Rocky Mountain:										
Idaho	764	734	499	470	22	6	1	58	1	176
Montana	386	336	172	137	4	31		19	1	144
South Dakota (West)	150	42	23	23				2		17
Wyoming	164	57	42	36	2	3	1	7		8
Total	1,464	1,169	736	666	28	40	2	86	2	345
Southern Rocky Mountain:										
Arizona	119	96	94	60	2	32				2
Colorado	796	422	316	310	3	2	1	4	2	100
Nevada	38	28	7	7	(2)	(2)		(2)	(2)	21
New Mexico	235	206	131	56	30	38	7	15		60
Utah	82	60	41	33	8	(2)		6		13
Total	1,270	812	589	466	43	72	8	25	2	196
Total, West	12,777	8,553	4,097	3,520	240	181	156	497	151	3,808
Continental United States	60,339	51,948	5,617	4,567	247	210	593	1,439	1,196	43,696

[1] Plantable area refers to nonstocked or poorly stocked forest land or nonforest land: (a) on which the establishment or interplanting of forest tree cover is desirable and practical, and (b) on which regeneration will not occur naturally to a desirable density within a reasonable time.

[2] Less than 0.5 thousand acres.

continental United States, by ownership class and section, region, and State, January 1, 1953 [1]—Continued

Noncommercial forest land									Shelterbelts					
Total	Federal ownership or trusteeship: Total	Federal ownership or trusteeship: National forest	Federal ownership or trusteeship: Bureau of Land Management	Federal ownership or trusteeship: Indian	Federal ownership or trusteeship: Other	State	County and municipal	Private	Total	Federal ownership or trusteeship: Total	Federal ownership or trusteeship: Indian	Federal ownership or trusteeship: Other	County and municipal	Private
Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
100	5	5				11	11	73	2					2
55						15	15	25	8					8
112						10	10	92	75					75
30						10	10	10	35					35
105						20	50	35	4					4
402	5	5				66	96	235	124					124
135								135	430				30	400
70								70	688				28	660
20								20	664					664
161								161	130					130
61	1		1					60	400					400
1								1	25				1	24
448	1		1					447	2,337				59	2,278
1,506	58	55	1		2	169	186	1,093	2,661				59	2,602
237	220	185	15	10	10	11		6	2					2
117	107	82		15	10	6		4	8					8
354	327	267	15	25	20	17		10	10					10
3,107	1,867	980	880	2	5	40		1,200						
									30					30
									50					50
58	15	15				13		30	50					50
47	22	10	1	10	1	7	1	17	60	5	5			55
105	37	25	1	10	1	20	1	47	190	5	5			185
19	6	(2)		6				13	4	1	1			3
324	183	60	120	1	2	30	1	110	50	2	1	1	1	47
2	1	1						1	8	2	1	1	1	5
23	7			6	1			16	6			(2)		6
7	4	(2)	4					3	15		(2)	(2)		15
375	201	61	124	13	3	30	1	143	83	5	3	2	2	76
3,941	2,432	1,333	1,020	50	29	107	2	1,400	283	10	8	2	2	271
5,447	2,490	1,388	1,021	50	31	276	188	2,493	2,944	10	8	2	61	2,873

TABLE 20.—*Commercial forest land area in the United States and Coastal Alaska, by stand-size class, degree of stocking, and section and region, January 1, 1953*

Section and region	All areas	Sawtimber stands		Sawtimber stands: Young growth				Poletimber stands				Seedling and sapling stands				Non-stocked and other areas
		Total	Old growth [1]	Total	Well stocked [2]	Medium stocked [3]	Poorly stocked [4]	Total	Well stocked [2]	Medium stocked [3]	Poorly stocked [4]	Total	Well stocked [2]	Medium stocked [3]	Poorly stocked [4]	
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
North:																
New England	30, 658	10, 302	--------	10, 302	8, 877	1, 042	383	14, 501	11, 625	1, 845	1, 031	4, 969	2, 876	1, 290	803	886
Middle Atlantic	42, 225	15, 002	--------	15, 002	9, 760	4, 188	1, 054	16, 991	11, 113	4, 325	1, 553	8, 842	3, 966	2, 653	2, 223	1, 390
Lake States	53, 272	6, 457	--------	6, 457	633	2, 534	3, 290	16, 010	1, 971	5, 913	8, 126	20, 370	8, 306	7, 366	4, 698	10, 435
Central	42, 394	14, 486	--------	14, 486	10, 287	3, 040	1, 159	15, 722	8, 959	5, 109	1, 654	8, 957	3, 166	3, 760	2, 031	3, 229
Plains	5, 492	1, 475	25	1, 450	376	251	823	2, 289	705	576	1, 008	1, 053	188	141	724	675
Total	174, 041	47, 722	25	47. 697	29, 933	11, 055	6. 709	65, 513	34, 373	17, 768	13, 372	44, 191	18, 502	15, 210	10, 479	16, 615
South:																
South Atlantic	46, 152	16, 833	--------	16, 833	12, 406	3, 317	1, 110	18. 212	13, 235	3, 027	1, 950	9, 631	5, 985	2, 275	1, 371	1, 476
Southeast	94, 985	24, 505	--------	24, 505	12, 873	9, 893	1, 739	37, 201	15, 661	15, 515	6, 025	21, 097	3, 999	7, 957	9, 141	12, 182
West Gulf	52, 151	19, 164	--------	19, 164	14, 584	4, 151	429	22, 963	11, 065	9, 273	2, 625	7, 610	1, 728	2, 739	3, 143	2, 414
Total	193, 288	60, 502	--------	60, 502	39, 863	17, 361	3, 278	78, 376	39, 961	27, 815	10, 600	38, 338	11, 712	12, 971	13, 655	16, 072
West:																
Pacific Northwest:																
Douglas-fir subregion	25, 455	14, 611	7, 468	7, 143	4, 572	2, 257	314	4, 542	2, 344	1, 752	446	4, 260	895	2, 211	1, 154	2, 042
Pine subregion	19, 910	14, 065	9, 910	4, 155	1, 674	1, 690	791	3, 968	1, 875	1, 459	634	1, 227	471	469	287	650
Total	45, 365	28, 676	17, 378	11, 298	6, 246	3, 947	1, 105	8, 510	4, 219	3, 211	1, 080	5, 487	1, 366	2, 680	1, 441	2, 692
California	17, 317	14, 038	11, 240	2, 798	1, 028	872	898	1, 122	190	435	497	44	4	11	29	2, 113
Northern Rocky Mountain	33, 840	15, 039	9, 173	5, 866	1, 642	1, 918	2, 306	11, 275	4, 612	3, 882	2, 781	4, 710	2, 382	1, 250	1, 078	2, 816
Southern Rocky Mountain	20, 489	12, 639	8, 239	4, 400	1, 282	1, 464	1, 654	4, 612	1, 451	2, 003	1, 158	1, 939	594	763	582	1, 299
Total	117, 011	70, 392	46, 030	24, 362	10, 198	8, 201	5, 963	25, 519	10, 472	9, 531	5, 516	12, 180	4, 346	4, 704	3, 130	8, 920
United States	484, 340	178, 616	46, 055	132, 561	79, 994	36, 617	15, 950	169, 408	84, 806	55, 114	29, 488	94, 709	34, 560	32, 885	27, 264	41, 607
Coastal Alaska	4, 269	4, 092	3, 954	138	130	7	1	75	71	1	3	75	29	41	5	27
All regions	488, 609	182, 708	50, 009	132, 699	80, 124	36, 624	15, 951	169, 483	84, 877	55, 115	29, 491	94, 784	34, 589	32, 926	27, 269	41, 634

[1] There is still some old-growth sawtimber in the East, but it is scattered and its area is relatively small. For this reason, none of the East's sawtimber area has been classified as old growth except a small area of ponderosa pine in eastern South Dakota. Elsewhere in the East, the area is included with young-growth sawtimber.

[2] 70–100 percent stocked.

[3] 40–69 percent stocked.

[4] 10–39 percent stocked.

TABLE 21.—*Commercial forest land area in the United States and Coastal Alaska, by major forest type groups and section and region, January 1, 1953*

EASTERN TYPE GROUPS

Section and region	Total, all types	White-red-jack pine	Longleaf-slash pine	Loblolly-shortleaf pine	Spruce-fir	Oak-pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch	Aspen-birch
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
North:											
New England	30, 658	3, 418	--------	165	10, 560	49	3, 180	--------	824	10, 558	1, 904
Middle Atlantic	42, 225	1, 649	--------	2, 772	868	564	18, 624	2, 716	1, 424	10, 732	2, 876
Lake States	53, 272	4, 445	--------	--------	10, 016	--------	6, 443	--------	4, 609	9, 308	18, 451
Central	42, 394	31	--------	580	--------	1, 722	28, 994	1, 283	7, 638	2, 062	84
Plains	5, 492	[1] 442	--------	220	--------	110	1, 333	920	2, 333	--------	134
Total	174, 041	9, 985	--------	3, 737	21, 444	2, 445	58, 574	4, 919	16, 828	32, 660	23, 449
South:											
South Atlantic	46, 152	208	1, 564	16, 319	16	5, 479	14, 919	7, 389	--------	258	--------
Southeast	94, 985	106	22, 346	22, 751	2	8, 704	24, 104	15, 993	448	531	--------
West Gulf	52, 151	--------	2, 581	15, 698	--------	6, 261	14, 617	11, 992	1, 002	--------	--------
Total	193, 288	314	26, 491	54, 768	18	20, 444	53, 640	35, 374	1, 450	789	--------
Eastern United States	367, 329	10, 299	26, 491	58, 505	21, 462	22, 889	112, 214	40, 293	18, 278	33, 449	23, 449

See footnote at end of table.

TABLE 21.—*Commercial forest land area in the United States and Coastal Alaska, by major forest type groups and section and region, January 1, 1953*—Continued

WESTERN TYPE GROUPS

Section and region	Total, all types	Douglas-fir	Hemlock-Sitka spruce	Redwood	Ponderosa pine	White pine	Lodgepole pine	Larch	Fir-spruce	Pinyon-pine-juniper	Hardwood
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
West:											
Pacific Northwest:											
Douglas-fir subregion	25, 455	18, 270	3, 518	2	678	262	207		1, 634		884
Pine subregion	19, 910	1, 871	27		12, 725	329	1, 847	1, 149	1, 808		154
Total	45, 365	20, 141	3, 545	2	13, 403	591	2, 054	1, 149	3, 442		1, 038
California	17, 317	4, 378	6	1, 588	6, 057	2, 255	300		2, 733		
Northern Rocky Mountain	33, 840	6, 222			7, 879	2, 520	9, 649	3, 273	2, 707	855	735
Southern Rocky Mountain	20, 489	990			10, 123	13	2, 464		4, 737		2, 162
Total	117, 011	31, 731	3, 551	1, 590	37, 462	5, 379	14, 467	4, 422	13, 619	855	3, 935
Coastal Alaska	4, 269		4, 263								6
Western United States and Coastal Alaska	121, 280	31, 731	7, 814	1, 590	37, 462	5, 379	14, 467	4, 422	13, 619	855	3, 941

[1] Ponderosa pine. The total area of ponderosa pine type in the United States is 37,904 thousand acres including 442 thousand acres in the Plains Region.

TABLE 22.—*Commercial forest land area in the United States and Coastal Alaska, by ownership class, section and region, and stand-size class, January 1, 1953*

NORTH

Region and stand-size class	All ownerships	Federal ownership or trusteeship: Total	National forest	Indian [1]	Bureau of Land Management [1]	Other [1]	State [1]	County and municipal [1]	Private
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
New England:									
Sawtimber stands	10, 302	492	466			26	126	50	9, 634
Poletimber stands	14, 501	278	253			25	312	120	13, 791
Seedling and sapling stands	4, 969	114	87			27	129	79	4, 647
Nonstocked and other areas	886	20	16			4	13	8	845
Total	30, 658	904	822			82	580	257	28, 917
Middle Atlantic:									
Sawtimber stands	15, 002	532	473			59	780	62	13, 628
Poletimber stands	16, 991	582	513			69	1, 797	166	14, 446
Seedling and sapling stands	8, 842	376	338			38	925	89	7, 452
Nonstocked and other areas	1, 390	51	15			36	143	11	1, 185
Total	42, 225	1, 541	1, 339			202	3, 645	328	36, 711
Lake States:									
Sawtimber stands	6, 457	904	648	205	4	47	461	244	4, 848
Poletimber stands	16, 010	2, 727	2, 204	382	19	122	2, 304	1, 677	9, 302
Seedling and sapling stands	20, 370	3, 022	2, 505	293	21	203	3, 037	2, 919	11, 392
Nonstocked and other areas	10, 435	887	538	239	23	87	1, 945	1, 312	6, 291
Total	53, 272	7, 540	5, 895	1, 119	67	459	7, 747	6, 152	31, 833
Central:									
Sawtimber stands	14, 486	1, 067	905	(2)	1	161	204	23	13, 192
Poletimber stands	15, 722	708	539	1		168	207	18	14, 789
Seedling and sapling stands	8, 957	690	596	(2)		94	87	7	8, 173
Nonstocked and other areas	3, 229	167	141	(2)		26	11	1	3, 050
Total	42, 394	2, 632	2, 181	1	1	449	509	49	39, 204
Plains:									
Sawtimber stands	1, 475	79	5	60		14	17		1, 379
Poletimber stands	2, 289	141	24	97	1	19	30		2, 118
Seedling and sapling stands	1, 053	145	14	106	3	22	12		896
Nonstocked and other areas	675	112	2	105		5	6		557
Total	5, 492	477	45	368	4	60	65	(2)	4, 950
Total, North:									
Sawtimber stands	47, 722	3, 074	2, 497	265	5	307	1, 588	379	42, 681
Poletimber stands	65, 513	4, 436	3, 533	480	20	403	4, 650	1, 981	54, 446
Seedling and sapling stands	44, 191	4, 347	3, 540	399	24	384	4, 190	3, 094	32, 560
Nonstocked and other areas	16, 615	1, 237	712	344	23	158	2, 118	1, 332	11, 928
Total	174, 041	13, 094	10, 282	1, 488	72	1, 252	12, 546	6, 786	141, 615

See footnotes at end of table.

TABLE 22.—*Commercial forest land area in the United States and Coastal Alaska, by ownership class, section and region, and stand-size class, January 1, 1953*—Continued

SOUTH

Region and stand-size class	All ownerships	Federal ownership or trusteeship					State [1]	County and municipal [1]	Private
		Total	National forest	Indian [1]	Bureau of Land Management [1]	Other [1]			
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
South Atlantic:									
Sawtimber stands	16, 833	1, 282	1, 014	35		233	99	33	15, 419
Poletimber stands	18, 212	1, 362	1, 173	6		183	150	32	16, 668
Seedling and sapling stands	9, 631	737	543	6		188	166	15	8, 713
Nonstocked and other areas	1, 476	103	53			50	35	2	1, 336
Total	46, 152	3, 484	2, 783	47		654	450	82	42, 136
Southeast:									
Sawtimber stands	24, 505	2, 102	1, 423	5	8	666	243	214	21, 946
Poletimber stands	37, 201	2, 137	1, 530	3	7	597	367	145	34, 552
Seedling and sapling stands	21, 097	1, 028	581	3	4	440	113	105	19, 851
Nonstocked and other areas	12, 182	970	358	35	9	568	294	71	10, 847
Total	94, 985	6, 237	3, 892	46	28	2, 271	1, 017	535	87, 196
West Gulf:									
Sawtimber stands	19, 164	1, 749	1, 498	5	46	200	125	4	17, 286
Poletimber stands	22, 963	1, 986	1, 714	10	46	216	158	3	20, 816
Seedling and sapling stands	7, 610	536	356	8	29	143	96	2	6, 976
Nonstocked and other areas	2, 414	204	129	1	5	69	11	(2)	2, 199
Total	52, 151	4, 475	3, 697	24	126	628	390	9	47, 277
Total, South:									
Sawtimber stands	60, 502	5, 133	3, 935	45	54	1, 099	467	251	54, 651
Poletimber stands	78, 376	5, 485	4, 417	19	53	996	675	180	72, 036
Seedling and sapling stands	38, 338	2, 301	1, 480	17	33	771	375	122	35, 540
Nonstocked and other areas	16, 072	1, 277	540	36	14	687	340	73	14, 382
Total	193, 288	14, 196	10, 372	117	154	3, 553	1, 857	626	176, 609

WEST

Region and stand-size class	All ownerships	Total	National forest	Indian	Bureau of Land Management	Other	State	County and municipal	Private
Pacific Northwest:									
Douglas-fir subregion:									
Sawtimber stands	14, 611	7, 540	5, 680	155	1, 684	21	593	148	6, 330
Poletimber stands	4, 542	895	618	61	208	8	478	135	3, 034
Seedling and sapling stands	4, 260	772	558	25	164	25	616	123	2, 749
Nonstocked and other areas	2, 042	500	283	16	200	1	284	46	1, 212
Total	25, 455	9, 707	7, 139	257	2, 256	55	1, 971	452	13, 325
Pine subregion:									
Sawtimber stands	14, 065	9, 970	7, 672	2, 071	218	9	418	37	3, 640
Poletimber stands	3, 968	2, 090	1, 595	353	127	15	180	9	1, 689
Seedling and sapling stands	1, 227	612	495	60	36	21	39	7	569
Nonstocked and other areas	650	271	208	22	23	18	28		351
Total	19, 910	12, 943	9, 970	2, 506	404	63	665	53	6, 249
Total, Pacific Northwest:									
Sawtimber stands	28, 676	17, 510	13, 352	2, 226	1, 902	30	1, 011	185	9, 970
Poletimber stands	8, 510	2, 985	2, 213	414	335	23	658	144	4, 723
Seedling and sapling stands	5, 487	1, 384	1, 053	85	200	46	655	130	3, 318
Nonstocked and other areas	2, 692	771	491	38	223	19	312	46	1, 563
Total	45, 365	22, 650	17, 109	2, 763	2, 660	118	2, 636	505	19, 574
California:									
Sawtimber stands	14, 038	7, 565	7, 198	107	231	29	147	6	6, 320
Poletimber stands	1, 122	486	448	9	28	1	15	(2)	621
Seedling and sapling stands	44	23	22	(2)	1	(2)	(2)		21
Nonstocked and other areas	2, 113	996	905	17	64	10	24	2	1, 091
Total	17, 317	9, 070	8, 573	133	324	40	186	8	8, 053
Northern Rocky Mountain:									
Sawtimber stands	15, 039	10, 756	9, 867	409	469	11	851	14	3, 418
Poletimber stands	11, 275	8, 032	7, 237	303	482	10	380	23	2, 840
Seedling and sapling stands	4, 710	3, 364	3, 175	83	81	25	197	25	1, 124
Nonstocked and other areas	2, 816	1, 586	1, 348	27	174	37	136	17	1, 077
Total	33, 840	23, 738	21, 627	822	1, 206	83	1, 564	79	8, 459

See footnotes at end of table.

Table 22.—*Commercial forest land area in the United States and Coastal Alaska, by ownership class, section and region, and stand-size class, January 1, 1953*—Continued

NORTH

Region and stand-size class	All ownerships	Federal ownership or trusteeship: Total	National forest	Indian [1]	Bureau of Land Management [1]	Other [1]	State [1]	County and municipal [1]	Private
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Southern Rocky Mountain:									
Sawtimber stands	12, 639	11, 147	8, 830	1, 463	834	20	162	8	1, 322
Poletimber stands	4, 612	2, 665	2, 403	113	125	24	131	16	1, 800
Seedling and sapling stands	1, 939	1, 426	1, 340	13	69	4	51	16	446
Nonstocked and other areas	1, 299	888	778	33	69	8	36	3	372
Total	20, 489	16, 126	13, 351	1, 622	1, 097	56	380	43	3, 940
Total West:									
Sawtimber stands	70, 392	46, 978	39, 247	4, 205	3, 436	90	2, 171	213	21, 030
Poletimber stands	25, 519	14, 168	12, 301	839	970	58	1, 184	183	9, 984
Seedling and sapling stands	12, 180	6, 197	5, 590	181	351	75	903	171	4, 909
Nonstocked and other areas	8, 920	4, 241	3, 522	115	530	74	508	68	4, 103
Total	117, 011	71, 584	60, 660	5, 340	5, 287	297	4, 766	635	40, 026

SUMMARY

Region and stand-size class	All ownerships	Federal ownership or trusteeship: Total	National forest	Indian [1]	Bureau of Land Management [1]	Other [1]	State [1]	County and municipal [1]	Private
United States:									
Sawtimber stands	178, 616	55, 185	45, 679	4, 515	3, 495	1, 496	4, 226	843	118, 362
Poletimber stands	169, 408	24, 089	20, 251	1, 338	1, 043	1, 457	6, 509	2, 344	136, 466
Seedling and sapling stands	94, 709	12, 845	10, 610	597	408	1, 230	5, 468	3, 387	73, 009
Nonstocked and other areas	41, 607	6, 755	4, 774	495	567	919	2, 966	1, 473	30, 413
Total	484, 340	98, 874	81, 314	6, 945	5, 513	5, 102	19, 169	8, 047	358, 250
Coastal Alaska:									
Sawtimber stands	4, 092	4, 076	3. 360	19	697				16
Poletimber stands	75	73	34	1	38				2
Seedling and sapling stands	75	74	34		40				1
Nonstocked and other areas	27	27	17		10				
Total	4, 269	4, 250	3, 445	20	785				19
All Regions:									
Sawtimber stands	182, 708	59, 261	49, 039	4, 534	4, 192	1, 496	4, 226	843	118, 378
Poletimber stands	169, 483	24, 162	20, 285	1, 339	1, 081	1, 457	6, 509	2, 344	136, 468
Seedling and sapling stands	94, 784	12, 919	10, 644	597	448	1, 230	5, 468	3, 387	73, 010
Nonstocked and other areas	41, 634	6, 782	4, 791	495	577	919	2, 966	1, 473	30, 413
Total	488, 609	103, 124	84, 759	6, 965	6, 298	5, 102	19, 169	8, 047	358, 269

[1] Because of different definitions of commercial forest land adopted by the Forest Service and other public agencies, acreage figures for these ownerships may vary from actual published commercial forest land acreages of the public agencies concerned.

[2] Less than 0.5 thousand acres.

TABLE 23.—*Commercial forest land area in private ownership in the United States and Coastal Alaska, by size class, section and region, and type of ownership, 1953* [1]

Section, region, and type of ownership	All classes	Under 100 acres [2]	100 to 500 acres	500 to 5,000 acres	5,000 to 50,000 acres	50,000 acres and larger
NORTH						
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
New England:						
Farm	6, 138	2, 528	3, 157	406	47	
Lumber manufacturer	1, 002	61	198	371	372	
Pulp manufacturer	6, 840				616	6, 224
Other wood manufacturer	336				35	301
Other private	14, 601	5, 311	4, 140	804	1, 183	3, 163
Total	28, 917	7, 900	7, 495	1, 581	2, 253	9, 688
Middle Atlantic:						
Farm	11, 800	7, 685	3, 636	479		
Lumber manufacturer	977	56	228	284	274	135
Pulp manufacturer	889				91	798
Other wood manufacturer	203	3			128	72
Other private	22, 842	10, 861	5, 503	2, 439	2, 854	1, 185
Total	36, 711	18, 605	9, 367	3, 202	3, 347	2, 190
Lake States:						
Farm	15, 184	9, 859	4, 961	364		
Lumber manufacturer	1, 435	36	49	79	396	875
Pulp manufacturer	1, 495				230	1, 265
Other wood manufacturer	109		13	23	13	60
Other private	13, 610	5, 878	3, 907	1, 211	1, 000	1, 614
Total	31, 833	15, 773	8, 930	1, 677	1, 639	3, 814
Central: [3]						
Farm	24, 697	16, 046	7, 465	1, 150	36	
Lumber manufacturer	541	55	65	347	74	
Other wood manufacturer	276	1	1		23	251
Other private	13, 690	6, 824	3, 862	1, 984	871	149
Total	39, 204	22, 926	11, 393	3, 481	1, 004	400
Plains: [3]						
Farm	3, 575	2, 929	317	229	100	
Other private	1, 375	1, 205	106	44	20	
Total	4, 950	4, 134	423	273	120	
Total, North:						
Farm	61, 394	39, 047	19, 536	2, 628	183	
Lumber manufacturer	3, 955	208	540	1, 081	1, 116	1, 010
Pulp manufacturer	9, 224				929	8, 295
Other wood manufacturer	924	4	14	23	199	684
Other private	66, 118	30, 079	17, 518	6, 482	5, 852	6, 187
Total	141, 615	69, 338	37, 608	10, 214	8, 279	16, 176
SOUTH						
South Atlantic:						
Farm	29, 968	13, 388	12, 489	3, 570	521	
Lumber manufacturer	2, 620	109	583	196	1, 142	590
Pulp manufacturer	2, 603				98	2, 505
Other wood manufacturer	391			30	278	83
Other private	6, 554	1, 653	1, 810	1, 699	944	448
Total	42, 136	15, 150	14, 882	5, 495	2, 983	3, 626
Southeast:						
Farm	45, 957	16, 698	16, 851	9, 911	2, 497	
Lumber manufacturer	6, 587	96	256	580	3, 205	2, 450
Pulp manufacturer	6, 963				94	6, 869
Other wood manufacturer	1, 893		43	46	1, 301	503
Other private	25, 796	4, 300	7, 595	5, 605	4, 804	3, 492
Total	87, 196	21, 094	24, 745	16, 142	11, 901	13, 314
West Gulf:						
Farm	14, 218	6, 751	5, 920	1, 384	163	
Lumber manufacturer	9, 310	30	327	215	2, 042	6, 696
Pulp manufacturer	2, 622			141		2, 481
Other wood manufacturer	534	19	56		311	148
Other private	20, 593	5, 271	6, 519	4, 051	2, 775	1, 977
Total	47, 277	12, 071	12, 822	5, 791	5, 291	11, 302
Total, South:						
Farm	90, 143	36, 837	35, 260	14, 865	3, 181	
Lumber manufacturer	18, 517	235	1, 166	991	6, 389	9, 736
Pulp manufacturer	12, 188			141	157	11, 890
Other wood manufacturer	2, 818	19	99	76	1, 890	734
Other private	52, 943	11, 224	15, 924	11, 355	8, 523	5, 917
Total	176, 609	48, 315	52, 449	27, 428	20, 140	28, 277

See footnotes at end of table.

TABLE 23.—*Commercial forest land area in private ownership in the United States and Coastal Alaska, by size class, section and region, and type of ownership, 1953* [1]—Continued

WEST

Section, region, and type of ownership	All classes	Under 100 acres [2]	100 to 500 acres	500 to 5,000 acres	5,000 to 50,000 acres	50,000 acres and larger
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Pacific Northwest:						
Farm	5,344	1,217	1,910	2,022	195	
Lumber manufacturer	6,858	24	122	478	1,614	4,620
Pulp manufacturer	1,681			6	256	1,419
Other wood manufacturer	341		109	19	213	
Other private	5,350	951	2,075	1,021	587	716
Total	19,574	2,192	4,216	3,546	2,865	6,755
California:						
Farm	1,586	95	331	742	418	
Lumber manufacturer	3,076		52	212	1,368	1,444
Pulp manufacturer	173					173
Other wood manufacturer	140		3	19	118	
Other private	3,078	206	636	320	393	1,523
Total	8,053	301	1,022	1,293	2,297	3,140
Northern Rocky Mountain:						
Farm	4,001	427	1,638	1,936		
Lumber manufacturer	2,131		21	351	216	1,543
Pulp manufacturer	10				10	
Other wood manufacturer	190				25	165
Other private	2,127	214	167	323	358	1,065
Total	8,459	641	1,826	2,610	609	2,773
Southern Rocky Mountain: [3]						
Farm	2,749	158	544	939	557	551
Lumber manufacturer	150		4	24		122
Other wood manufacturer	6				6	
Other private	1,035	68	204	324	109	330
Total	3,940	226	752	1,287	672	1,003
Total, West:						
Farm	13,680	1,897	4,423	5,639	1,170	551
Lumber manufacturer	12,215	24	199	1,065	3,164	7,763
Pulp manufacturer	1,864			6	266	1,592
Other wood manufacturer	677		112	38	362	165
Other private	11,590	1,439	3,082	1,988	1,438	3,643
Total	40,026	3,360	7,816	8,736	6,400	13,714

SUMMARY

Section, region, and type of ownership	All classes	Under 100 acres [2]	100 to 500 acres	500 to 5,000 acres	5,000 to 50,000 acres	50,000 acres and larger
United States:						
Farm	165,217	77,781	59,219	23,132	4,534	551
Lumber manufacturer	34,687	467	1,905	3,137	10,634	18,544
Pulp manufacturer	23,276			147	1,278	21,851
Other wood manufacturer	4,419	23	225	137	2,451	1,583
Other private	130,651	42,742	36,524	19,825	15,772	15,788
Total	358,250	121,013	97,873	46,378	34,669	58,317
Coastal Alaska: [3]						
Other private	19	10	9			
All regions:						
Farm	165,217	77,781	59,219	23,132	4,534	551
Lumber manufacturer	34,687	467	1,905	3,137	10,634	18,544
Pulp manufacturer	23,276			147	1,278	21,851
Other wood manufacturer	4,419	23	225	137	2,451	1,583
Other private	130,670	42,752	36,533	19,825	15,772	15,788
Total	358,269	121,023	97,882	46,378	34,669	58,317

[1] The determination of size class of ownership was based on the total commercial forest land area in the ownership. Some pulp company ownerships now primarily producing lumber were classified as lumber manufacturers. This was particularly true in the Lake States.

[2] Includes ownerships containing 3 to 100 acres of commercial forest land in the East and 10 to 100 acres in the West.

[3] Certain types of ownerships were omitted in these regions because ownership of the omitted types were absent or were so small that total areas by size class would not be adequately determined by sampling procedure.

TABLE 24.—*Commercial forest land area in private ownership in the United States and Coastal Alaska,*

Section and region	All classes			Small private holdings					
				Total			Under 100 acres [2]		
	Area	Owners	Average size holding	Area	Owners	Average size holding	Area	Owners	Average size holding
	Thousand acres	*Number*	*Acres*	*Thousand acres*	*Number*	*Acres*	*Thousand acres*	*Number*	*Acres*
North:									
New England	28, 917	254, 550	114	16, 976	254, 378	67	7, 900	204, 114	39
Middle Atlantic	36, 711	764, 387	48	31, 174	764, 124	41	18, 605	700, 763	27
Lake States	31, 833	491, 882	65	26, 380	491, 774	54	15, 773	441, 909	36
Central	39, 204	886, 071	44	37, 800	885, 984	43	22, 926	814, 522	28
Plains	4, 950	157, 043	32	4, 830	157, 023	31	4, 134	154, 781	27
Total	141, 615	2, 553, 921	55	117, 160	2, 553, 283	46	69, 338	2, 316, 089	30
South:									
South Atlantic	42, 136	594, 432	71	35, 527	594, 165	60	15, 150	497, 356	30
Southeast	87, 196	778, 529	112	61, 981	777, 620	80	21, 094	613, 531	34
West Gulf	47, 277	454, 077	104	30, 684	453, 712	68	12, 071	365, 591	33
Total	176, 609	1, 827, 020	97	128, 192	1, 825, 497	70	48, 315	1, 476, 478	33
West:									
Pacific Northwest:									
Douglas-fir subregion	13, 325	67, 983	196	6, 117	67, 827	90	1, 859	52, 782	35
Pine subregion	6, 249	15, 937	392	3, 837	15, 869	242	333	7, 059	47
Total	19, 574	83, 912	233	9, 954	83, 696	119	2, 192	59, 841	37
California	8, 053	10, 464	770	2, 616	10, 307	254	301	5, 337	56
Northern Rocky Mountain	8, 459	27, 176	311	5, 077	27, 130	187	641	13, 965	46
Southern Rocky Mountain	3, 940	7, 754	508	2, 265	7, 687	295	226	3, 137	72
Total	40, 026	129, 291	310	19, 912	128, 820	154	3, 360	82, 280	41
United States	358, 250	4, 510, 213	79	265, 264	4, 507, 600	59	121, 013	3, 874, 847	31
Coastal Alaska	19	286	66	19	286	66	10	246	41
All regions	358, 269	4, 510, 499	79	265, 283	4, 507, 886	59	121, 023	3, 875, 093	31

[1] Because some owners have various size holdings in one or more regions, the determination of size class of private ownership and area owned was based on the total commercial forest land area in the ownership, and number of owners on the total number within each ownership class, whether for a region, section, or for the country as a whole. Thus, except for small ownerships, regional totals do not add to sectional totals that give the proper ownership distribution on a sectional basis, nor do sectional totals add to national totals that show correct ownership distribution for the entire country.

number of owners, average size of ownerships, and size class of owner, by section and region, 1953 [1]

Small private holdings—Continued						Medium private holdings—5,000 to 50,000 acres			Large private holdings—50,000 acres and larger		
100 to 500 acres			500 to 5,000 acres								
Area	Owners	Average size holding	Area	Owners	Average size holding	Area	Owners	Average size holding	Area	Owners	Average size holding
Thousand acres	*Number*	*Acres*	*Thousand acres*	*Number*	*Acres*	*Thousand acres*	*Number*	*Acres*	*Thousand acres*	*Number*	*Acres*
7,495	48,854	153	1,581	1,410	1,121	2,253	141	15,979	9,688	31	312,516
9,367	59,112	158	3,202	4,249	754	3,347	239	14,004	2,190	24	91,250
8,930	47,855	187	1,677	2,010	834	1,639	87	18,839	3,814	21	181,619
11,393	67,233	169	3,481	4,229	823	1,004	83	12,096	400	4	100,000
423	1,881	225	273	361	756	120	20	6,000	----------	----------	----------
37,608	224,935	167	10,214	12,259	833	8,279	563	14,705	16,176	75	215,680
14,882	90,688	164	5,495	6,121	898	2,983	244	12,225	3,626	23	157,652
24,745	149,917	165	16,142	14,172	1,139	11,901	827	14,390	13,314	82	162,366
12,822	81,809	157	5,791	6,312	917	5,291	308	17,179	11,302	57	198,281
52,449	322,414	163	27,428	26,605	1,031	20,140	1,367	14,733	28,277	156	181,263
2,534	13,350	190	1,724	1,695	1,017	2,199	133	16,534	5,009	23	217,783
1,682	7,470	225	1,822	1,340	1,360	791	58	13,638	1,621	10	162,100
4,216	20,820	202	3,546	3,035	1,168	2,865	186	15,403	6,755	30	225,167
1,022	3,971	257	1,293	999	1,294	2,297	141	16,291	3,140	16	196,250
1,826	10,886	168	2,610	2,279	1,145	609	37	16,459	2,773	9	308,111
752	3,401	221	1,287	1,149	1,120	672	56	12,000	1,003	11	91,182
7,816	39,078	200	8,736	7,462	1,171	6,400	409	15,648	13,714	62	221,194
97,873	586,427	167	46,378	46,326	1,001	34,669	2,330	14,879	58,317	283	206,067
9	40	225	----------	----------	----------	----------	----------	----------	----------	----------	----------
97,882	586,467	167	46,378	46,326	1,001	34,669	2,330	14,879	58,317	283	206,067

Data were lacking on which to adjust for possible duplication of ownerships in the small ownership classes when considered strictly on a sectional or national basis. Such duplication that may exist in small ownerships is, however, believed to affect relatively less area and fewer owners than in the medium and large classes.

[2] Includes ownerships containing 3 to 100 acres of commercial forest land in the East and 10 to 100 acres in the West.

TABLE 25.—*Net volume of live sawtimber on commercial forest land in the United States and Coastal Alaska, by ownership class, section and region, and softwoods and hardwoods, January 1, 1953* [1]

NORTH

Region and species group	All owner-ships	Federal ownership or trusteeship					State [2]	County and munici-pal [2]	Private		
		Total	National forest	Indian [2]	Bureau of Land Manage-ment [2]	Other [2]			Total	Farm	Forest industries and other
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
New England:											
Softwood	27, 169	1, 245	1, 177			68	283	167	25, 474	6, 425	19, 049
Hardwood	24, 356	1, 187	1, 133			54	394	165	22, 610	6, 039	16, 571
Total	51, 525	2, 432	2, 310			122	677	332	48, 084	12, 464	35, 620
Middle Atlantic:											
Softwood	13, 328	228	172			56	969	67	12, 064	3, 481	8, 583
Hardwood	61, 023	1, 729	1, 519			210	4, 085	276	54, 933	15, 291	39, 642
Total	74, 351	1, 957	1, 691			266	5, 054	343	66, 997	18, 772	48, 225
Lake States:											
Softwood	14, 355	3, 955	2, 743	1, 075	23	114	1, 975	1, 068	7, 357	2, 053	5, 304
Hardwood	35, 435	4, 235	2, 909	1, 070	12	244	2, 393	1, 593	27, 214	15, 008	12, 206
Total	49, 790	8, 190	5, 652	2, 145	35	358	4, 368	2, 661	34, 571	17, 061	17, 510
Central:											
Softwood	3, 420	247	200			47	30	3	3, 140	1, 637	1, 503
Hardwood	79, 251	4, 118	3, 241	2	1	874	884	126	74, 123	47, 136	26, 987
Total	82, 671	4, 365	3, 441	2	1	921	914	129	77, 263	48, 773	28, 490
Plains:											
Softwood	670	108	13	95			10	2	550	389	161
Hardwood	7, 007	315		221	1	93	20	10	6, 662	4, 813	1, 849
Total	7, 677	423	13	316	1	93	30	12	7, 212	5, 202	2, 010
Total, North:											
Softwood	58, 942	5, 783	4, 305	1, 170	23	285	3, 267	1, 307	48, 585	13, 985	34, 600
Hardwood	207, 072	11, 584	8, 802	1, 293	14	1, 475	7, 776	2, 170	185, 542	88, 287	97, 255
Total	266, 014	17, 367	13, 107	2, 463	37	1, 760	11, 043	3, 477	234, 127	102, 272	131, 855

SOUTH

Region and species group	All owner-ships	Federal Total	National forest	Indian	Bureau of Land Management	Other	State	County and municipal	Private Total	Farm	Forest industries and other
South Atlantic:											
Softwood	51, 144	3, 163	2, 140	20		1, 003	571	77	47, 333	31, 627	15, 706
Hardwood	55, 714	4, 642	4, 118	60		464	346	101	50, 625	34, 191	16, 434
Total	106, 858	7, 805	6, 258	80		1, 467	917	178	97, 958	65, 818	32, 140
Southeast:											
Softwood	76, 833	7, 957	5, 266	19	23	2, 649	717	242	67, 917	29, 635	38, 282
Hardwood	62, 469	4, 623	2, 944	14	13	1, 652	612	726	56, 508	28, 719	27, 789
Total	139, 302	12, 580	8, 210	33	36	4, 301	1, 329	968	124, 425	58, 354	66, 071
West Gulf:											
Softwood	54, 956	6, 516	6, 182	7	54	273	228	6	48, 206	5, 920	42, 286
Hardwood	55, 952	3, 486	2, 566	17	173	730	563	13	51, 890	13, 722	38, 168
Total	110, 908	10, 002	8, 748	24	227	1, 003	791	19	100, 096	19, 642	80, 454
Total, South:											
Softwood	182, 933	17, 636	13, 588	46	77	3, 925	1, 516	325	163, 456	67, 182	96, 274
Hardwood	174, 135	12, 751	9, 628	91	186	2, 846	1, 521	840	159, 023	76, 632	82, 391
Total	357, 068	30, 387	23, 216	137	263	6, 771	3, 037	1, 165	322, 479	143, 814	178, 665

See footnotes at end of table.

TABLE 25.—*Net volume of live sawtimber on commercial forest land in the United States and Coastal Alaska, by ownership class, section and region, and softwoods and hardwoods, January 1, 1953* [1]—Continued

WEST

Region and species group	All ownerships	Federal ownership or trusteeship: Total	Federal: National forest	Federal: Indian [2]	Federal: Bureau of Land Management [2]	Federal: Other [2]	State [2]	County and municipal [2]	Private: Total	Private: Farm	Private: Forest industries and other
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Pacific Northwest:											
Douglas-fir subregion:											
Softwood	577, 116	284, 344	218, 791	6, 474	58, 199	880	27, 398	6, 348	259, 026	12, 537	246, 489
Hardwood	17, 259	4, 059	2, 867	285	907	----------	1, 155	199	11, 846	566	11, 280
Total	594, 375	288, 403	221, 658	6, 759	59, 106	880	28, 553	6, 547	270, 872	13, 103	257, 769
Pine subregion:											
Softwood	154, 317	110, 557	87, 165	20, 943	2, 356	93	4, 291	361	39, 108	2, 752	36, 356
Hardwood	184	122	84	35	3	----------	9	----------	53	3	50
Total	154, 501	110, 679	87, 249	20, 978	2, 359	93	4, 300	361	39, 161	2, 755	36, 406
Total, Pacific Northwest:											
Softwood	731, 433	394, 901	305, 956	27, 417	60, 555	973	31, 689	6, 709	298, 134	15, 289	282, 845
Hardwood	17, 443	4, 181	2, 951	320	910	----------	1, 164	199	11, 899	569	11, 330
Total	748, 876	399, 082	308. 907	27, 737	61, 465	973	32, 853	6, 908	310. 033	15, 858	294, 175
California:											
Softwood	354, 024	186, 482	176, 595	3, 863	5, 665	359	4, 442	189	162, 911	30, 403	132, 508
Hardwood	5, 977	2, 587	2, 318	106	152	11	105	6	3, 279	976	2, 303
Total	360, 001	189, 069	178, 913	3, 969	5, 817	370	4, 547	195	166, 190	31, 37	134, 811
Northern Rocky Mountain:											
Softwood	165, 682	114, 877	108, 167	2, 771	3, 890	49	11, 805	121	38, 879	9, 501	29, 378
Hardwood	1, 340	468	65	380	23	----------	27	2	843	427	416
Total	167, 022	115, 345	108, 232	3, 151	3, 913	49	11, 832	123	39, 722	9, 928	29, 794
Southern Rocky Mountain:											
Softwood	65, 589	58, 299	48, 424	7, 373	2, 412	90	765	39	6, 486	3, 756	2, 730
Hardwood	3, 219	2, 211	2, 052	76	65	18	67	1	940	796	144
Total	68, 808	60, 510	50, 476	7, 449	2, 477	108	832	40	7, 426	4, 552	2, 874
Total, West:											
Softwood	1, 316, 728	754, 559	639, 142	41, 424	72, 522	1, 471	48, 701	7, 058	506, 410	58, 949	447, 461
Hardwood	27, 979	9, 447	7, 386	882	1, 150	29	1, 363	208	16, 961	2, 768	14, 193
Total	1, 344, 707	764, 006	646, 528	42, 306	73, 672	1, 500	50, 064	7, 266	523, 371	61, 717	461, 654

SUMMARY

Region and species group	All ownerships	Federal ownership or trusteeship: Total	Federal: National forest	Federal: Indian [2]	Federal: Bureau of Land Management [2]	Federal: Other [2]	State [2]	County and municipal [2]	Private: Total	Private: Farm	Private: Forest industries and other
United States:											
Softwood	1, 558, 603	777, 978	657, 035	42, 640	72, 622	5, 681	53, 484	8, 690	718, 451	140, 116	578, 335
Hardwood	409, 186	33, 782	25, 816	2, 266	1, 350	4, 350	10, 660	3, 218	361, 526	167, 687	193, 839
Total	1, 967, 789	811, 760	682, 851	44, 906	73, 972	10, 031	64, 144	11, 908	1, 079, 977	307, 803	772, 174
Coastal Alaska:											
Softwood	88, 951	88, 629	82, 481	61	6, 087	----------	----------	----------	322	----------	322
Hardwood	107	107	43	----------	64	----------	----------	----------	[3]	----------	[3]
Total	89, 058	88, 736	82, 524	61	6, 151	----------	----------	----------	322	----------	322
All regions:											
Softwood	1, 647, 554	866, 607	739, 516	42, 701	78, 709	5, 681	53, 484	8, 690	718, 773	140, 116	578, 657
Hardwood	409, 293	33, 889	25, 859	2, 266	1, 414	4, 350	10, 660	3, 218	361, 526	167, 687	193, 839
Total	2, 056, 847	900, 496	765, 375	44, 967	80, 123	10, 031	64, 144	11, 908	1, 080, 299	307, 803	772, 496

[1] Net volume in board-feet log scale, International ¼-inch rule.

[2] Because of different definitions of commercial forest land, different cruising standards, specifications, and log rules adopted by the Forest Service and other public agencies, volume estimates for these ownerships may vary from actual published figures of the public agencies concerned.

[3] Less than 0.5 million board-feet.

TABLE 26.—*Net volume of live sawtimber on commercial forest land in Eastern United States, by species group and section and region, January 1, 1953* [1]

Species group	Total, Eastern United States	North: Total	North: New England	North: Middle Atlantic	North: Lake States	North: Central	North: Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Softwoods:											
White and red pine	17,330	16,262	7,602	3,577	5,015	68		1,068	737	331	
Jack pine	2,104	2,104	1	20	2,083						
Longleaf and slash pine	36,638							36,638	3,184	31,083	2,371
Shortleaf and loblolly pine	124,744	3,992		1,725		1,897	370	120,752	36,968	35,078	48,706
Other pines	12,251	2,176	41	1,555		580		10,075	6,148	3,625	302
Spruce and balsam fir	19,084	19,074	14,440	1,937	2,697			10	10		
Hemlock	12,333	10,928	3,749	4,012	2,735	432		1,405	1,113	292	
Cypress	12,682	280				280	(2)	12,402	2,761	6,097	3,544
Other	4,709	4,126	1,336	502	1,825	163	[3] 300	583	223	327	33
Total	241,875	58,942	27,169	13,328	14,355	3,420	[3] 670	182,933	51,144	76,833	54,956
Hardwoods:											
White oak [4]	35,432	20,552	423	6,683	1,965	11,294	7	14,880	5,664	5,125	4,091
Other white oak	27,342	10,844	39	2,126	784	7,423	472	16,498	5,325	4,731	6,442
Red oak [5]	31,023	23,554	1,709	10,178	5,600	5,894	173	7,469	2,576	2,553	2,340
Other red oak	52,592	19,872	347	3,166	1,145	14,565	649	32,720	8,630	12,536	11,554
Yellow birch	11,701	11,647	5,824	3,924	1,890	9		54	25	11	18
Sugar maple	22,929	22,517	6,315	7,289	6,080	2,833		412	141	217	54
Soft maple	13,913	10,195	1,098	4,304	2,047	2,704	42	3,718	2,183	1,088	447
Beech	15,888	13,147	2,055	6,174	1,068	3,850		2,741	772	1,211	758
Sweetgum	25,750	1,953		883		910	160	23,797	6,927	8,299	8,571
Tupelo and blackgum	24,563	1,756	3	654		1,017	82	22,807	8,874	8,373	5,560
Ash	11,027	6,297	355	1,655	1,425	2,477	385	4,730	1,334	1,307	2,089
Hickory	23,896	9,032	93	2,046	150	6,688	55	14,864	3,535	6,111	5,218
Cottonwood and aspen	9,376	7,914	348	309	3,958	1,617	1,682	1,462	88	558	816
Basswood	6,763	6,298	112	2,026	2,759	1,271	130	465	192	235	38
Yellow-poplar	16,370	6,791	107	3,035		3,649		9,579	5,675	3,845	59
Black walnut	2,109	1,687		83	27	1,408	169	422	162	206	54
Other	50,533	33,016	5,528	6,308	6,537	11,642	3,001	17,517	3,611	6,063	7,843
Total	381,207	207,072	24,356	61,023	35,435	79,251	7,007	174,135	55,714	62,469	55,952
All species	623,082	266,014	51,525	74,351	49,790	82,671	7,677	357,068	106,858	139,302	110,908

[1] Net volume in board-feet log scale, International ¼-inch rule. This table is similar in format to table 10 of Basic Forest Statistics for the United States, January 1945 (revised 1950 issue) but the data are not directly comparable because of changes in standards between 1945 and 1952.

[2] Less than 0.5 million board-feet.

[3] Includes 294 million board-feet of ponderosa pine. The total volume of ponderosa and Jeffrey pine in the United States is 224,503 million board-feet including 294 million board-feet in the Plains Region.

[4] *Quercus alba* and *Q. prinus*.

[5] *Quercus borealis*, *Q. falcata* var. *pagodaefolia*, and *Q. shumardii*.

TABLE 27.—*Net volume of live sawtimber on commercial forest land in Western United States and Coastal Alaska, by species group and section and region, January 1, 1953* [1]

Species group	Total, Western United States and Coastal Alaska	West: Total	West: Pacific Northwest: Total	West: Pacific Northwest: Douglas-fir subregion	West: Pacific Northwest: Pine subregion	West: California	West: Northern Rocky Mountain	West: Southern Rocky Mountain	Coastal Alaska
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Softwoods:									
Douglas-fir	531,868	531,868	365,912	337,251	28,661	116,912	43,220	5,824	
Ponderosa and Jeffrey pine	[2] 224,209	[2] 224,209	92,232	5,900	86,332	66,741	33,061	32,175	
True firs	183,705	183,705	73,508	58,428	15,080	88,717	16,983	4,497	
Western hemlock	171,895	117,497	114,735	112,065	2,670	478	2,284		54,398
Sugar pine	35,121	35,121	7,737	7,418	319	27,384			
Western white pine	21,383	21,383	4,771	3,244	1,527	2,131	14,474	7	
Redwood	36,214	36,214	90	90		36,124			
Sitka spruce	35,888	9,293	9,123	9,123		170			26,595
Engelmann and other spruces	37,135	36,962	3,371	410	2,961		17,737	15,854	173
Western larch	28,019	28,019	10,348	210	10,138		17,671		
Western redcedar	36,295	31,654	28,198	27,575	623	2	3,454		4,641
California incense-cedar	13,296	13,296	3,557	3,321	236	9,727		12	
Lodgepole pine	30,126	30,051	3,553	334	3,219	3,807	15,891	6,800	75
Other	20,525	17,456	14,298	11,747	2,551	1,831	907	420	3,069
Total	1,405,679	1,316,728	731,433	577,116	154,317	354,024	165,682	65,589	88,951
Hardwoods:									
Cottonwood and aspen	3,742	3,742	123		123	37	463	3,119	
Red alder	9,414	9,414	9,245	9,245		166		3	
Other	14,930	14,823	8,075	8,014	61	5,774	877	97	107
Total	28,086	27,979	17,443	17,259	184	5,977	1,340	3,219	107
All species	1,433,765	1,344,707	748,876	594,375	154,501	360,001	167,022	68,808	89,058

[1] Net volume in board-feet log scale, International ¼-inch rule. This table is similar in format to table 10 of Basic Forest Statistics for the United States, January 1945 (revised 1950 issue), but the data are not directly comparable because of changes in standards between 1945 and 1952.

[2] Excludes 294 million board-feet of ponderosa pine in the Plains Region. The total volume of ponderosa and Jeffrey pine in the United States is 224,503 million board-feet.

TABLE 28.—*Net volume of live sawtimber on commercial forest land in Eastern United States, by section and region, species group, and diameter class, January 1, 1953* [1]

SOFTWOODS

Species group and d. b. h. class (inches)	Total East	North						South			
		Total	New England	Middle Atlantic	Lake States	Central	Plains	Total	South Atlantic	South-east	West Gulf
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Southern yellow pine:											
9.0–10.9	41, 893	1, 654	14	854		693	93	40, 239	10, 613	20, 001	9, 625
11.0–14.9	77, 297	3, 133	18	1, 659		1, 271	185	74, 164	19, 877	31, 995	22, 292
15.0–18.9	37, 528	1, 084	9	629		372	74	36, 444	10, 264	12, 493	13, 687
19.0 and larger	16, 915	297		138		141	18	16, 618	5, 546	5, 297	5, 775
Total	173, 633	6, 168	41	3, 280		2, 477	370	167, 465	46, 300	69, 786	51, 379
White and red pine:											
9.0–10.9	2, 947	2, 834	1, 431	553	850			113	74	39	
11.0–14.9	6, 236	5, 901	2, 697	1, 306	1, 896	2		335	240	95	
15.0–18.9	4, 347	4, 010	1, 869	972	1, 150	19		337	243	94	
19.0 and larger	3, 800	3, 517	1, 605	746	1, 119	47		283	180	103	
Total	17, 330	16, 262	7, 602	3, 577	5, 015	68		1, 068	737	331	
Other softwoods:											
9.0–10.9	12, 088	9, 741	4, 873	1, 322	3, 380	114	52	2, 347	423	1, 586	338
11.0–14.9	19, 752	14, 497	7, 808	2, 607	3, 664	238	180	5, 255	1, 230	2, 870	1, 155
15.0–18.9	9, 862	6, 758	3, 890	1, 459	1, 147	219	43	3, 104	908	1, 018	1, 178
19.0 and larger	9, 210	5, 516	2, 955	1, 083	1, 149	304	25	3, 694	1, 546	1, 242	906
Total	50, 912	36, 512	19, 526	6, 471	9, 340	875	[2] 300	14, 400	4, 107	6, 716	3, 577
All softwoods:											
9.0–10.9	56, 928	14, 229	6, 318	2, 729	4, 230	807	145	42, 699	11, 110	21, 626	9, 963
11.0–14.9	103, 285	23, 531	10, 523	5, 572	5, 560	1, 511	365	79, 754	21, 347	34, 960	23, 447
15.0–18.9	51, 737	11, 852	5, 768	3, 060	2, 297	610	117	39, 885	11, 415	13, 605	14, 865
19.0 and larger	29, 925	9, 330	4, 560	1, 967	2, 268	492	43	20, 595	7, 272	6, 642	6, 681
Total	241, 875	58, 942	27, 169	13, 328	14, 355	3, 420	[2] 670	182, 933	51, 144	76, 833	54, 956
HARDWOODS											
White oaks:											
11.0–14.9	27, 491	14, 153	307	4, 046	1, 675	7, 874	251	13, 338	5, 009	4, 159	4, 170
15.0–18.9	17, 380	8, 694	89	2, 529	722	5, 237	117	8, 686	2, 741	2, 704	3, 241
19.0 and larger	17, 903	8, 549	66	2, 414	352	5, 606	111	9, 354	3, 239	2, 993	3, 122
Total	62, 774	31, 396	462	8, 989	2, 749	18, 717	479	31, 378	10, 989	9, 856	10, 533
Red oaks:											
11.0–14.9	33, 347	17, 900	1, 081	5, 352	4, 066	7, 214	187	15, 447	4, 654	5, 713	5, 080
15.0–18.9	24, 826	12, 997	585	4, 047	1, 822	6, 282	261	11, 829	3, 118	4, 547	4, 164
19.0 and larger	25, 442	12, 529	390	3, 945	857	6, 963	374	12, 913	3, 434	4, 829	4, 650
Total	83, 615	43, 426	2, 056	13, 344	6, 745	20, 459	822	40, 189	11, 206	15, 089	13, 894
Sweetgum, tupelo, and blackgum:											
11.0–14.9	22, 651	1, 484	3	622		756	103	21, 167	7, 275	8, 127	5, 765
15.0–18.9	16, 858	1, 282		578		614	90	15, 576	5, 334	5, 272	4, 970
19.0 and larger	10, 804	943		337		557	49	9, 861	3, 192	3, 273	3, 396
Total	50, 313	3, 709	3	1, 537		1, 927	242	46, 604	15, 801	16, 672	14, 131
Yellow-poplar:											
11.0–14.9	6, 482	2, 510	42	1, 191		1, 277		3, 972	2, 380	1, 569	23
15.0–18.9	5, 380	2, 218	29	929		1, 260		3, 162	1, 768	1, 375	19
19.0 and larger	4, 508	2, 063	36	915		1, 112		2, 445	1, 527	901	17
Total	16, 370	6, 791	107	3, 035		3, 649		9, 579	5, 675	3, 845	59
Yellow birch:											
11.0–14.9	4, 104	4, 091	2, 298	1, 052	734	7		13	5	4	4
15.0–18.9	3, 188	3, 167	1, 647	972	546	2		21	6	5	10
19.0 and larger	4, 409	4, 389	1, 879	1, 900	610			20	14	2	4
Total	11, 701	11, 647	5, 824	3, 924	1, 890	9		54	25	11	18
Sugar maple:											
11.0–14.9	8, 811	8, 680	2, 608	2, 462	2, 658	952		131	13	95	23
15.0–18.9	7, 005	6, 898	1, 930	2, 211	1, 961	796		107	28	61	18
19.0 and larger	7, 113	6, 939	1, 777	2, 616	1, 461	1, 085		174	100	61	13
Total	22, 929	22, 517	6, 315	7, 289	6, 080	2, 833		412	141	217	54
Beech:											
11.0–14.9	5, 415	4, 705	985	2, 338	644	738		710	276	228	206
15.0–18.9	5, 173	4, 303	751	2, 128	308	1, 116		870	210	374	286
19.0 and larger	5, 300	4, 139	319	1, 708	116	1, 996		1, 161	286	609	266
Total	15, 888	13, 147	2, 055	6, 174	1, 068	3, 850		2, 741	772	1, 211	758

See footnotes at end of table.

TABLE 28.—*Net volume of live sawtimber on commercial forest land in Eastern United States, by section and region, species group, and diameter class, January 1, 1953* [1]—Continued

HARDWOODS—Continued

Species group and d. b. h. class (inches)	Total East	North						South			
		Total	New England	Middle Atlantic	Lake States	Central	Plains	Total	South Atlantic	South-east	West Gulf
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Other hardwoods:											
11.0–14.9	52,685	34,269	3,865	7,972	10,095	10,759	1,578	18,416	5,004	7,085	6,327
15.0–18.9	33,793	20,324	2,149	4,765	3,943	7,875	1,592	13,469	3,138	4,858	5,473
19.0 and larger	31,139	19,846	1,520	3,994	2,865	9,173	2,294	11,293	2,963	3,625	4,705
Total	117,617	74,439	7,534	16,731	16,903	27,807	5,464	43,178	11,105	15,568	16,505
All hardwoods:											
11.0–14.9	160,986	87,792	11,189	25,035	19,872	29,577	2,119	73,194	24,616	26,980	21,598
15.0–18.9	113,603	59,883	7,180	18,159	9,302	23,182	2,060	53,720	16,343	19,196	18,181
19.0 and larger	106,618	59,397	5,987	17,829	6,261	26,492	2,828	47,221	14,755	16,293	16,173
Total	381,207	207,072	24,356	61,023	35,435	79,251	7,007	174,135	55,714	62,469	55,952
ALL SPECIES											
All species:											
9.0–10.9	56,928	14,229	6,318	2,729	4,230	807	145	42,699	11,110	21,626	9,963
11.0–14.9	264,271	111,323	21,712	30,607	25,432	31,088	2,484	152,948	45,963	61,940	45,045
15.0–18.9	165,340	71,735	12,948	21,219	11,599	23,792	2,177	93,605	27,758	32,801	33,046
19.0 and larger	136,543	68,727	10,547	19,796	8,529	26,984	2,871	67,816	22,027	22,935	22,854
Total	623,082	266,014	51,525	74,351	49,790	82,671	7,677	357,068	106,858	139,302	110,908

[1] Net volume in board-feet log scale, International ¼-inch rule.
[2] Includes 294 million board-feet of ponderosa pine consisting of 226 million board-feet 9.0 to 14.9 inches d. b. h. and 68 million board-feet 15.0 inches and larger. The total volume of ponderosa and Jeffrey pine in the United States is 224,503 million board-feet including 294 million board-feet in the Plains Region.

TABLE 29.—*Net volume of live softwood sawtimber on commercial forest land in Western United States and Coastal Alaska, by species group, diameter class, and section and region, January 1, 1953* [1]

Species group and d. b. h. class (inches)	Total, Western United States and Coastal Alaska	West							Coastal Alaska
		Total, West	Pacific Northwest			California	Northern Rocky Mountain	Southern Rocky Mountain	
			Total	Douglas-fir subregion	Pine subregion				
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Ponderosa and Jeffrey pine:									
11.0–20.9	45,438	45,438	15,983	471	15,512	7,533	10,970	10,952	
21.0–30.9	81,323	81,323	36,970	1,530	35,440	17,136	12,387	14,830	
31.0 and larger	97,448	97,448	39,279	3,899	35,380	42,072	9,704	6,393	
Total	224,209	[2] 224,209	92,232	5,900	86,332	66,741	33,061	32,175	
Sugar and western white pine:									
11.0–20.9	11,725	11,725	2,217	1,273	944	1,956	7,550	2	
21.0–30.9	11,594	11,594	2,219	1,499	720	4,669	4,704	2	
31.0 and larger	33,185	33,185	8,072	7,890	182	22,890	2,220	3	
Total	56,504	56,504	12,508	10,662	1,846	29,515	14,474	7	
Douglas-fir:									
11.0–20.9	94,120	94,120	59,939	50,907	9,032	9,171	22,862	2,148	
21.0–30.9	122,268	122,268	81,804	70,865	10,939	23,033	15,253	2,178	
31.0 and larger	315,480	315,480	224,169	215,479	8,690	84,708	5,105	1,498	
Total	531,868	531,868	365,912	337,251	28,661	116,912	43,220	5,824	
Redwood:									
11.0–20.9	3,363	3,363	5	5		3,358			
21.0–30.9	4,499	4,499	9	9		4,490			
31.0 and larger	28,352	28,352	76	76		28,276			
Total	36,214	36,214	90	90		36,124			
Other softwoods:									
11.0–20.9	164,199	133,066	54,566	35,894	18,672	15,867	45,643	16,990	31,133
21.0–30.9	167,714	139,250	79,330	65,452	13,878	30,188	22,135	7,597	28,464
31.0 and larger	224,971	195,617	126,795	121,867	4,928	58,677	7,149	2,996	29,354
Total	556,884	467,933	260,691	223,213	37,478	104,732	74,927	27,583	88,951
All softwoods:									
11.0–20.9	318,845	287,712	132,710	88,550	44,160	37,885	87,025	30,092	31,133
21.0–30.9	387,398	358,934	200,332	139,355	60,977	79,516	54,479	24,607	28,464
31.0 and larger	699,436	670,082	398,391	349,211	49,180	236,623	24,178	10,890	29,354
Total	1,405,679	1,316,728	731,433	577,116	154,317	354,024	165,682	65,589	88,951

[1] Net volume in board-feet log scale, International ¼-inch rule.
[2] Excludes 294 million board-feet of ponderosa pine in the Plains Region. The total volume of ponderosa and Jeffrey pine in the United States is 224,503 million board-feet.

TABLE 30.—*Net volume of growing stock on commercial forest land in Eastern United States, by section and region, species group, and diameter class, January 1, 1953* [1]

SOFTWOODS

Species group and d. b. h. class (inches)	Total East	North						South			
		Total	New England	Middle Atlantic	Lake States	Central	Plains	Total	South Atlantic	Southeast	West Gulf
	Million cords	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*
White and red pines:											
5.0–6.9	5.0	4.4	2.0	1.0	1.4	(3)		0.6	0.5	0.1	
7.0–8.9	11.4	11.0	6.0	3.0	2.0	(3)		.4	.2	.2	
9.0–10.9	12.1	11.6	7.0	2.0	2.6			.5	.3	.2	
11.0 and larger	38.7	36.9	17.0	9.0	10.7	0.2		1.8	1.2	.6	
Total	67.2	63.9	32.0	15.0	16.7	.2		3.3	2.2	1.1	
Jack pine:											
5.0–6.9	4.9	4.9			4.9						
7.0–8.9	5.2	5.2			5.2						
9.0–10.9	3.2	3.2			3.2						
11.0 and larger	2.9	2.9			2.9						
Total	16.2	16.2			16.2						
Southern yellow pines:											
5.0–6.9	86.9	4.9	(2)	3.0		1.8	0.1	82.0	27.0	42.1	12.9
7.0–8.9	131.7	7.2	(2)	4.0		3.1	.1	124.5	40.1	62.9	21.5
9.0–10.9	127.6	7.5	(2)	5.0		2.2	.3	120.1	33.3	60.3	26.5
11.0 and larger	321.6	12.3	1.0	6.0		4.7	.6	309.3	87.1	124.3	97.9
Total	667.8	31.9	1.0	18.0		11.8	1.1	635.9	187.5	289.6	158.8
Spruce and balsam fir:											
5.0–6.9	22.7	22.6	11.0	1.0	10.6			.1	.1		
7.0–8.9	23.2	23.1	14.0	1.0	8.1			.1	.1		
9.0–10.9	17.4	17.4	11.0	2.0	4.4						
11.0 and larger	41.4	41.4	32.0	6.0	3.4						
Total	104.7	104.5	68.0	10.0	26.5			.2	.2		
Hemlock:											
5.0–6.9	5.5	5.4	2.0	3.0	.4	(3)		.1	.1		
7.0–8.9	8.2	7.9	3.0	4.0	.8	.1		.3	.2	.1	
9.0–10.9	7.4	7.1	3.0	3.0	1.0	.1		.3	.2	.1	
11.0 and larger	26.3	23.8	8.0	9.0	6.1	.7		2.5	2.0	.5	
Total	47.4	44.2	16.0	19.0	8.3	.9		3.2	2.5	.7	
Cypress:											
5.0–6.9	6.2					(3)	(3)	6.2	.9	4.9	.4
7.0–8.9	8.2					(3)	(3)	8.2	1.3	6.0	.9
9.0–10.9	6.3					(3)	(3)	6.3	.8	4.5	1.0
11.0 and larger	26.5	.9				.9	(3)	25.6	6.1	11.6	7.9
Total	47.2	.9				.9	(3)	46.3	9.1	27.0	10.2
Other softwoods:											
5.0–6.9	9.9	8.6	2.0	1.0	4.6	.8	.2	1.3	.6	.6	.1
7.0–8.9	8.6	7.4	1.0	1.0	4.5	.6	.3	1.2	.6	.5	.1
9.0–10.9	4.3	3.7	1.0		2.2	.4	.1	.6	.3	.3	(2)
11.0 and larger	11.9	11.0	3.0	4.0	2.8	.7	.5	.9	.2	.7	(2)
Total	34.7	30.7	7.0	6.0	14.1	2.5	[4] 1.1	4.0	1.7	2.1	.2
All softwoods:											
5.0–6.9	141.1	50.8	17.0	9.0	21.9	2.6	.3	90.3	29.2	47.7	13.4
7.0–8.9	196.5	61.8	24.0	13.0	20.6	3.8	.4	134.7	42.5	69.7	22.5
9.0–10.9	178.3	50.5	22.0	12.0	13.4	2.7	.4	127.8	34.9	65.4	27.5
11.0 and larger	469.3	129.2	61.0	34.0	25.9	7.2	1.1	340.1	96.6	137.7	105.8
Total	985.2	292.3	124.0	68.0	81.8	16.3	2.2	692.9	203.2	320.5	169.2

See footnotes at end of table.

TABLE 30.—*Net volume of growing stock on commercial forest land in Eastern United States, by section and region, species group, and diameter class, January 1, 1953* [1]—Continued

HARDWOODS

Species group and d. b. h. class (inches)	Total East	North: Total	North: New England	North: Middle Atlantic	North: Lake States	North: Central	North: Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
	Million cords	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*
Oak:											
5.0-6.9	77.9	42.5	2.0	19.0	6.1	14.3	1.1	35.4	10.5	13.9	11.0
7.0-8.9	108.2	59.2	4.0	23.0	7.7	23.4	1.1	49.0	15.3	19.5	14.2
9.0-10.9	131.0	67.6	4.0	24.0	8.4	29.7	1.5	63.4	19.9	24.9	18.6
11.0 and larger	433.4	217.1	9.0	68.0	25.0	111.0	4.1	216.3	54.9	78.5	82.9
Total	750.5	386.4	19.0	134.0	47.2	178.4	7.8	364.1	100.6	136.8	126.7
Beech-yellow birch-hard maple:											
5.0-6.9	30.6	29.7	11.0	13.0	4.1	1.6		.9	.4	.3	.2
7.0-8.9	39.9	38.5	16.0	15.0	5.3	2.2		1.4	.6	.5	.3
9.0-10.9	43.7	41.6	16.0	17.0	5.8	2.8		2.1	.9	.8	.4
11.0 and larger	128.4	118.7	36.0	41.0	24.1	17.6		9.7	2.4	4.7	2.6
Total	242.6	228.5	79.0	86.0	39.3	24.2		14.1	4.3	6.3	3.5
Hickory:											
5.0-6.9	15.4	6.9		2.0	.2	4.6	.1	8.5	2.0	4.1	2.4
7.0-8.9	20.8	9.5		2.0	.3	7.1	.1	11.3	2.4	5.7	3.2
9.0-10.9	24.0	9.8		2.0	.2	7.5	.1	14.2	3.6	6.2	4.3
11.0 and larger	73.3	27.0	1.0	7.0	.4	18.5	.1	46.3	9.2	19.6	17.5
Total	133.5	53.2	1.0	13.0	1.1	37.7	.4	80.3	17.2	35.7	27.4
Sweetgum:											
5.0- 6.9	14.0	1.4		1.0		.3	.1	12.6	3.5	5.8	3.3
7.0- 8.9	19.0	1.7		1.0		.7	(3)	17.3	5.0	7.5	4.8
9.0-10.9	25.4	1.0				.8	.2	24.4	5.8	11.3	7.3
11.0 and larger	79.3	6.3		3.0		2.7	.6	73.0	18.6	25.8	28.6
Total	137.7	10.4		5.0		4.5	.9	127.3	32.9	50.4	44.0
Tupelo and blackgum:											
5.0- 6.9	9.2	.2				.2	(3)	9.0	2.8	4.8	1.4
7.0- 8.9	15.4	.5				.4	.1	14.9	4.7	7.6	2.6
9.0-10.9	23.1	1.8		1.0		.7	.1	21.3	6.6	10.7	4.0
11.0 and larger	72.1	5.2		2.0		2.9	.3	66.9	22.4	25.4	19.1
Total	119.8	7.7		3.0		4.2	.5	112.1	36.5	48.5	27.1
Yellow-poplar:											
5.0- 6.9	6.5	2.7		2.0		.7		3.8	2.5	1.3	(2)
7.0- 8.9	9.0	3.4		2.0		1.4		5.6	3.5	2.1	(2)
9.0-10.9	11.5	4.8		3.0		1.8		6.7	3.8	2.9	(2)
11.0 and larger	44.4	17.8	(2)	8.0		9.8		26.6	14.6	11.8	.2
Total	71.4	28.7	(2)	15.0		13.7		42.7	24.4	18.1	.2
Cottonwood and aspen:											
5.0- 6.9	26.7	26.3	2.0	1.0	21.6	.2	1.5	.4	.1	.1	.2
7.0- 8.9	26.0	25.4	1.0	2.0	20.6	.2	1.6	.6	.2	.2	.2
9.0-10.9	16.7	16.1		1.0	13.8	.5	.8	.6	.1	.2	.3
11.0 and larger	25.9	21.4	1.0	1.0	11.1	4.6	3.7	4.5	.2	1.8	2.5
Total	95.3	89.2	4.0	5.0	67.1	5.5	7.6	6.1	.6	2.3	3.2
Other hardwoods:											
5.0- 6.9	79.4	59.7	18.0	14.0	14.6	10.9	2.2	19.7	6.7	8.3	4.7
7.0- 8.9	90.5	65.5	17.0	16.0	14.8	15.0	2.7	25.0	7.3	10.9	6.8
9.0-10.9	97.5	70.2	17.0	18.0	15.1	16.5	3.6	27.3	7.2	11.9	8.2
11.0 and larger	262.4	179.0	24.0	54.0	34.2	55.3	11.5	83.4	19.5	27.7	36.2
Total	529.8	374.4	76.0	102.0	78.7	97.7	20.0	155.4	40.7	58.8	55.9
All hardwoods:											
5.0- 6.9	259.7	169.4	33.0	52.0	46.6	32.8	5.0	90.3	28.5	38.6	23.2
7.0- 8.9	328.8	203.7	38.0	61.0	48.7	50.4	5.6	125.1	39.0	54.0	32.1
9.0-10.9	372.9	212.9	37.0	66.0	43.3	60.3	6.3	160.0	47.9	69.0	43.1
11.0 and larger	1,119.2	592.5	71.0	184.0	94.8	222.4	20.3	526.7	141.8	195.3	189.6
Total	2,080.6	1,178.5	179.0	363.0	233.4	365.9	37.2	902.1	257.2	356.9	288.0

ALL SPECIES

Species group and d. b. h. class (inches)	Total East	North: Total	North: New England	North: Middle Atlantic	North: Lake States	North: Central	North: Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
All species:											
5.0- 6.9	400.8	220.2	50.0	61.0	68.5	35.4	5.3	180.6	57.7	86.3	36.6
7.0- 8.9	525.3	265.5	62.0	74.0	69.3	54.2	6.0	259.8	81.5	123.7	54.6
9.0- 10.9	551.2	263.4	59.0	78.0	56.7	63.0	6.7	287.8	82.8	134.4	70.6
11.0 and larger	1,588.5	721.7	132.0	218.0	120.7	229.6	21.4	866.8	238.4	333.0	295.4
Total	3,065.8	1,470.8	303.0	431.0	315.2	382.2	39.4	1,595.0	460.4	677.4	457.2

[1] Net volume in standard cords (128 cu. ft.) including bark.
[2] Less than 0.5 million cords.
[3] Less than 0.05 million cords.
[4] Includes 1.0 million cords of ponderosa pine.

Table 31.—*Net volume of growing stock on commercial forest land in the United States and Coastal Alaska, by ownership class, section and region, and softwoods and hardwoods, January 1, 1953* [1]

NORTH

Region and species group	All owner-ships	Federal ownership or trusteeship: Total	National forest	Indian [2]	Bureau of Land Manage-ment [2]	Other [2]	State [2]	County and mu-nicipal [2]	Private: Total	Farm	In-dustrial and other
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
New England:											
Softwood	9,957	472	451			21					
Hardwood	14,388	621	587			34					
Total	24,345	1,093	1,038			55	474	204	22,574	5,949	16,625
Middle Atlantic:											
Softwood	5,390	110	77			33					
Hardwood	29,093	948	826			122					
Total	34,483	1,058	903			155	2,539	218	30,668	9,488	21,180
Lake States:											
Softwood	6,543	1,678	1,260	354	14	50					
Hardwood	18,675	2,590	1,939	502	8	141					
Total	25,218	4,268	3,199	856	22	191	2,953	1,972	16,025	7,651	8,374
Central:											
Softwood	1,042	76	61	(3)	(3)	15					
Hardwood	23,582	1,309	1,053	(3)	(3)	256					
Total	24,624	1,385	1,114	(3)	(3)	271	296	36	22,907	14,367	8,540
Plains:											
Softwood	214	87	72	15		(3)					
Hardwood	2,614	313	(3)	272	4	37					
Total	2,828	400	72	287	4	37	40		2,388	1,762	626
Total, North:											
Softwood	23,146	2,423	1,921	369	14	119					
Hardwood	88,352	5,781	4,405	774	12	590					
Total	111,498	8,204	6,326	1,143	26	709	6,302	2,430	94,562	39,217	55,345

SOUTH

Region and species group	All owner-ships	Federal ownership or trusteeship: Total	National forest	Indian [2]	Bureau of Land Manage-ment [2]	Other [2]	State [2]	County and mu-nicipal [2]	Private: Total	Farm	In-dustrial and other
South Atlantic:											
Softwood	14,877	945	660	5		280					
Hardwood	18,881	1,486	1,301	20		165					
Total	33,758	2,431	1,961	25		445	257	61	31,009	21,257	9,752
Southeast:											
Softwood	23,501	2,171	1,383	7	7	774					
Hardwood	24,454	1,495	1,021	6	5	463					
Total	47,955	3,666	2,404	13	12	1,237	469	372	43,448	21,557	21,891
West Gulf:											
Softwood	12,689	1,540	1,462	2	13	63					
Hardwood	19,299	1,220	917	5	56	242					
Total	31,988	2,760	2,379	7	69	305	220	5	29,003	6,628	22,375
Total, South:											
Softwood	51,067	4,656	3,505	14	20	1,117					
Hardwood	62,634	4,201	3,239	31	61	870					
Total	113,701	8,857	6,744	45	81	1,987	946	438	103,460	49,442	54,018

See footnotes at end of table.

TABLE 31.—*Net volume of growing stock on commercial forest land in the United States and Coastal Alaska, by ownership class, section and region, and softwoods and hardwoods, January 1, 1953* [1]—Continued

WEST

Region and species group	All ownerships	Federal ownership or trusteeship					State [2]	County and municipal [2]	Private		
		Total	National forest	Indian [2]	Bureau of Land Management [2]	Other [2]			Total	Farm	Industrial and other
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Pacific Northwest:											
Douglas-fir subregion:											
Softwood	107, 601	52, 543	40, 671	1, 266	10, 434	172					
Hardwood	5, 570	1, 210	853	91	266						
Total	113, 171	53, 753	41, 524	1, 357	10, 700	172	5, 589	1, 262	52, 567	2, 488	50, 079
Pine subregion:											
Softwood	32, 980	23, 114	18, 149	4, 402	532	31					
Hardwood	43	28	21	7							
Total	33, 023	23, 142	18, 170	4, 409	532	31	990	78	8, 813	604	8, 209
Total, Pacific Northwest:											
Softwood	140, 581	75, 657	58, 820	5, 668	10, 966	203					
Hardwood	5, 613	1, 238	874	98	266						
Total	146, 194	76, 895	59, 694	5, 766	11, 232	203	6, 579	1, 340	61, 380	3, 092	58, 288
California:											
Softwood	63, 664	32, 977	31, 216	645	1, 045	71					
Hardwood	3, 047	934	870	11	47	6					
Total	66, 711	33, 911	32, 086	656	1, 092	77	827	34	31, 939	6, 157	25, 782
Northern Rocky Mountain:											
Softwood	42, 290	30, 047	28, 259	678	1, 100	10					
Hardwood	473	201	119	78	4						
Total	42, 763	30, 248	28, 378	756	1, 104	10	2, 685	39	9, 791	2, 936	6, 855
Southern Rocky Mountain:											
Softwood	15, 934	13, 592	11, 681	1, 265	618	28					
Hardwood	1, 638	1, 154	1, 051	38	58	7					
Total	17, 572	14, 746	12, 732	1, 303	676	35	275	17	2, 534	1, 645	889
Total, West:											
Softwood	262, 469	152, 273	129, 976	8, 256	13, 729	312					
Hardwood	10, 771	3, 527	2, 914	225	375	13					
Total	273, 240	155, 800	132, 890	8, 481	14, 104	325	10, 366	1, 430	105, 644	13, 830	91, 814
SUMMARY											
United States:											
Softwood	336, 682	159, 352	135, 402	8, 639	13, 763	1, 548					
Hardwood	161, 757	13, 509	10, 558	1, 030	448	1, 473					
Total	498, 439	172, 861	145, 960	9, 669	14, 211	3, 021	17, 614	4, 298	303, 666	102, 489	201, 177
Coastal Alaska:											
Softwood	18, 473	18, 407	17, 130	13	1, 264						
Hardwood	23	22	9		13						
Total	18, 496	18, 429	17, 139	13	1, 277				67		67
All regions:											
Softwood	355, 155	177, 759	152, 532	8, 652	15, 027	1, 548					
Hardwood	161, 780	13, 531	10, 567	1, 030	461	1, 473					
Total	516, 935	191, 290	163, 099	9, 682	15, 488	3, 021	17, 614	4, 298	303, 733	102, 489	201, 244

[1] Net volume in cubic feet excluding bark. Estimates of net volume by softwoods and hardwoods not obtained for ownerships other than Federal.

[2] Because of different definitions of commercial forest land, different cruising standards, specifications, and log rules adopted by the Forest Service and other public agencies, volume estimates for these ownerships may vary from actual published figures of the public agencies concerned.

[3] Less than 0.5 million cubic feet.

TABLE 32.—*Net volume of all timber on commercial forest lands in the United States and Coastal Alaska, by class of material, section and region, and softwoods and hardwoods, January 1, 1953* [1]

Section, region, and species group	Total, all timber	Growing stock						Sound cull trees	Rotten cull trees	Hardwood limbs	Salvable dead trees		
		Total	Sawtimber trees			Pole-timber trees					Total	Saw-timber	Pole-timber
			Total	Saw-log portion	Upper stems								
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.		Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
North:													
New England:													
Softwood	10,677	9,957	6,643	5,348	1,295	3,314		616	104				
Hardwood	18,501	14,388	5,666	4,385	1,281	8,722		1,592	1,642	877	2	1	1
Total	29,178	24,345	12,309	9,733	2,576	12,036		2,208	1,746	877	2	1	1
Middle Atlantic:													
Softwood	5,758	5,390	3,630	2,927	703	1,760		304	64				
Hardwood	36,023	29,093	14,717	11,522	3,195	14,376		2,057	2,045	2,384	444	328	116
Total	41,781	34,483	18,347	14,449	3,898	16,136		2,361	2,109	2,384	444	328	116
Lake States:													
Softwood	6,858	6,543	3,147	2,534	613	3,396		92	214		9	5	4
Hardwood	23,331	18,675	7,575	6,231	1,344	11,100		828	2,141	1,667	20	11	9
Total	30,189	25,218	10,722	8,765	1,957	14,496		920	2,355	1,667	29	16	13
Central:													
Softwood	1,060	1,042	666	589	77	376		10	8				
Hardwood	36,286	23,582	14,688	12,602	2,086	8,894		1,776	2,944	7,874	110	81	29
Total	37,346	24,624	15,354	13,191	2,163	9,270		1,786	2,952	7,874	110	81	29
Plains:													
Softwood	232	214	126	115	11	88		15	1		2	1	1
Hardwood	3,948	2,614	1,432	1,118	314	1,182		370	197	757	10	6	4
Total	4,180	2,828	1,558	1,233	325	1,270		385	198	757	12	7	5
Total, North:													
Softwood	24,585	23,146	14,212	11,513	2,699	8,934		1,037	391		11	6	5
Hardwood	118,089	88,352	44,078	35,858	8,220	44,274		6,623	8,969	13,559	586	427	159
Total	142,674	111,498	58,290	47,371	10,919	53,208		7,660	9,360	13,559	597	433	164
South:													
South Atlantic:													
Softwood	15,951	14,877	10,258	8,331	1,927	4,619		951	119		4	2	2
Hardwood	27,146	18,881	11,219	9,098	2,121	7,662		3,507	1,961	2,769	28	14	14
Total	43,097	33,758	21,477	17,429	4,048	12,281		4,458	2,080	2,769	32	16	16
Southeast:													
Softwood	25,083	23,501	15,481	13,039	2,442	8,020		1,212	306		64	43	21
Hardwood	37,576	24,454	13,684	10,146	3,538	10,770		6,531	3,632	2,826	133	97	36
Total	62,659	47,955	29,165	23,185	5,980	18,790		7,743	3,938	2,826	197	140	57
West Gulf:													
Softwood	12,928	12,689	9,996	9,151	845	2,693		117	60		62	42	20
Hardwood	27,865	19,299	12,713	8,827	3,886	6,586		3,881	2,109	2,499	77	55	22
Total	40,793	31,988	22,709	17,978	4,731	9,279		3,998	2,169	2,499	139	97	42
Total, South:													
Softwood	53,962	51,067	35,735	30,521	5,214	15,332		2,280	485		130	87	43
Hardwood	92,587	62,634	37,616	28,071	9,545	25,018		13,919	7,702	8,094	238	166	72
Total	146,549	113,701	73,351	58,592	14,759	40,350		16,199	8,187	8,094	368	253	115
West:													
Pacific Northwest:													
Douglas-fir subregion:													
Softwood	116,476	107,601	97,514	90,688	6,826	10,087		246	4,361		4,268	3,877	391
Hardwood	5,782	5,570	3,541	3,293	248	2,029			155	36	21	13	8
Total	122,258	113,171	101,055	93,981	7,074	12,116		246	4,516	36	4,289	3,890	399
Pine subregion:													
Softwood	33,870	32,980	27,695	25,663	2,032	5,285		56	280		554	524	30
Hardwood	45	43	34	30	4	9			2	[2]			
Total	33,915	33,023	27,729	25,693	2,036	5,294		56	282	[2]	554	524	30
Total, Pacific Northwest:													
Softwood	150,346	140,581	125,209	116,351	8,858	15,372		302	4,641		4,822	4,401	421
Hardwood	5,827	5,613	3,575	3,323	252	2,038			157	36	21	13	8
Total	156,173	146,194	128,784	119,674	9,110	17,410		302	4,798	36	4,843	4,414	429

See footnotes at end of table.

TABLE 32.—*Net volume of all timber on commercial forest land in the United States and Coastal Alaska, by class of material, section and region, and softwoods and hardwoods, January 1, 1953* [1]—Continued

Section, region, and species group	Total, all timber	Growing stock						Sound cull trees	Rotten cull trees	Hard-wood limbs	Salvable dead trees		
		Total	Sawtimber trees			Pole-timber trees					Total	Saw-timber	Pole-timber
			Total	Saw-log portion	Upper stems								
West—Continued	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*		*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
California:													
Softwood	64, 870	63, 664	60, 244	52, 456	7, 788	3, 420		57	820		329	329	
Hardwood	5, 061	3, 047	1, 512	1, 212	300	1, 535		318	115	1, 581			
Total	69, 931	66, 711	61, 756	53, 668	8, 088	4, 955		375	935	1, 581	329	329	
Northern Rocky Mountain:													
Softwood	46, 113	42, 290	27, 273	24, 738	2, 535	15, 017		247	2, 061		1, 515	1, 063	452
Hardwood	502	473	323	271	52	150		2	16	4	7	3	4
Total	46, 615	42, 763	27, 596	25, 009	2, 587	15, 167		249	2, 077	4	1, 522	1, 066	456
Southern Rocky Mountain:													
Softwood	17, 727	15, 934	11, 640	10, 298	1, 342	4, 294		406	413		974	849	125
Hardwood	1, 821	1, 638	716	540	176	922		80	56	7	40	17	23
Total	19, 548	17, 572	12, 356	10, 838	1, 518	5, 216		486	469	7	1, 014	866	148
Total, West:													
Softwood	279, 056	262, 469	224, 366	203, 843	20, 523	38, 103		1, 012	7, 935		7, 640	6, 642	998
Hardwood	13, 211	10, 771	6, 126	5, 346	780	4, 645		400	344	1, 628	68	33	35
Total	292, 267	273, 240	230, 492	209, 189	21, 303	42, 748		1, 412	8, 279	1, 628	7, 708	6, 675	1, 033
United States:													
Softwood	357, 603	336, 682	274, 313	245, 877	28, 436	62, 369		4, 329	8, 811		7, 781	6, 735	1, 046
Hardwood	223, 887	161, 757	87, 820	69, 275	18, 545	73, 937		20, 942	17, 015	23, 281	892	626	266
Total	581, 490	498, 439	362, 133	315, 152	46, 981	136, 306		25, 271	25, 826	23, 281	8, 673	7, 361	1, 312
Coastal Alaska:													
Softwood	23, 728	18, 473	17, 073	16, 049	1, 024	1, 400		225	4, 972		58	58	
Hardwood	29	23	21	20	1	2		(2)	6	(2)			
Total	23, 757	18, 496	17, 094	16, 069	1, 025	1, 402		225	4, 978	(2)	58	58	
All regions:													
Softwood	381, 331	355, 155	291, 386	261, 926	29, 460	63, 769		4, 554	13, 783		7, 839	6, 793	1, 046
Hardwood	223, 916	161, 780	87, 841	69, 295	18, 546	73, 939		20, 942	17, 021	23, 281	892	626	266
Total	605, 247	516, 935	379, 227	331, 221	48, 006	137, 708		25, 496	30, 804	23, 281	8, 731	7, 419	1, 312

[1] Net volume in cubic feet excluding bark.

[2] Less than 0.5 million cubic feet.

TABLE 33.—*Net annual growth of live sawtimber on commercial forest land in Eastern United States, by species group and section and region, 1952* [1]

Species group	Total, Eastern United States	North						South			
		Total	New England	Middle Atlantic	Lake States	Central	Plains	Total	South Atlantic	South-east	West Gulf
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Softwood:											
White, red, and jack pine	906	845	298	124	417	6		61	41	20	
Southern yellow pine	14, 155	317	2	107		184	24	13, 838	3, 493	6, 378	3, 967
Spruce-fir	742	741	426	67	248			1	1		
Other softwoods	1, 167	572	188	172	137	59	[2] 16	595	135	281	179
All softwoods	16, 970	2, 475	914	470	802	249	40	14, 495	3, 670	6, 679	4, 146
Hardwood:											
Yellow-poplar	948	323	5	155		163		625	383	239	3
Other soft hardwoods	6, 041	2, 678	70	391	1, 239	742	236	3, 363	1, 018	1, 254	1, 091
Total	6, 989	3, 001	75	546	1, 239	905	236	3, 988	1, 401	1, 493	1, 094
Oaks	7, 316	3, 486	125	983	440	1, 872	66	3, 830	1, 334	1, 257	1, 239
Beech-yellow birch-hard maple	1, 877	1, 722	534	733	158	297		155	38	73	44
Other hard hardwoods	2, 939	1, 390	209	428	54	640	59	1, 549	437	533	579
Total	12, 132	6, 598	868	2, 144	652	2, 809	125	5, 534	1, 809	1, 863	1, 862
All hardwoods	19, 121	9, 599	943	2, 690	1, 891	3, 714	361	9, 522	3, 210	3, 356	2, 956
All species	36, 091	12, 074	1, 857	3, 160	2, 693	3, 963	401	24, 017	6, 880	10, 035	7, 102

[1] Net annual growth in board-feet log scale, International 1/4-inch rule.

[2] Net growth of ponderosa pine. The total net growth of ponderosa and Jeffrey pine in the United States is 1,857 million board-feet including 16 million board-feet in the Plains Region.

TABLE 34.—*Net annual growth of live sawtimber on commercial forest land in Western United States and Coastal Alaska, by species group and section and region, 1952* [1]

Species group	Total, Western United States and Coastal Alaska	West							Coastal Alaska
		Total West	Pacific Northwest			California	Northern Rocky Mountain	Southern Rocky Mountain	
			Total	Douglas-fir subregion	Pine subregion				
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Softwood:									
Douglas-fir	4,431	4,431	3,193	3,022	171	787	388	63	----
Ponderosa and Jeffrey pine	[2] 1,841	[2] 1,841	496	57	439	553	368	424	----
Western hemlock	1,038	967	931	911	20	9	27	----	71
White and sugar pine	535	535	119	98	21	207	209	----	----
Redwood	396	396	----	----	----	396	----	----	----
Other softwoods	2,800	2,744	1,095	922	173	943	516	190	56
Total	11,041	10,914	5,834	5,010	824	2,895	1,508	677	127
Hardwoods	265	264	143	139	4	44	26	51	1
All species	11,306	11,178	5,977	5,149	828	2,939	1,534	728	128

[1] Net annual growth in board-feet log scale, International 1/4-inch rule.
[2] Excludes 16 million board-feet of net growth of ponderosa pine in the Plains Region. The total net growth of ponderosa and Jeffrey pine in the United States is 1,857 million board-feet.

TABLE 35.—*Net annual growth of growing stock on commercial forest land in Eastern United States, by species group and section and region, 1952* [1]

VOLUME IN CUBIC FEET

Species group	Total, Eastern United States	North						South			
		Total	New England	Middle Atlantic	Lake States	Central	Plains	Total	South Atlantic	Southeast	West Gulf
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Softwoods:											
White, red, and jack pine	270	254	83	32	139	(2)	----	16	11	5	----
Southern yellow pine	3,483	87	1	48	----	33	5	3,396	920	1,630	846
Spruce-fir	291	290	145	23	122	----	----	1	1	----	----
Other softwoods	341	190	62	53	58	13	[3] 4	151	37	79	35
All softwoods	4,385	821	291	156	319	46	9	3,564	969	1,714	881
Hardwoods:											
Yellow-poplar	289	104	1	63	----	40	----	185	111	73	1
Other soft hardwoods	2,290	1,118	75	154	621	205	63	1,172	290	533	349
Total	2,579	1,222	76	217	621	245	63	1,357	401	606	350
Oaks	2,478	1,215	75	436	148	536	20	1,263	384	486	393
Beech-yellow birch-hard maple	718	671	252	272	77	70	----	47	11	23	13
Other hard hardwoods	1,306	730	184	276	15	231	24	576	143	227	206
Total	4,502	2,616	511	984	240	837	44	1,886	538	736	612
All hardwoods	7,081	3,838	587	1,201	861	1,082	107	3,243	939	1,342	962
All species	11,466	4,659	878	1,357	1,180	1,128	116	6,807	1,908	3,056	1,843

VOLUME IN CORDS

Species group	Total, Eastern United States	North Total	New England	Middle Atlantic	Lake States	Central	Plains	South Total	South Atlantic	Southeast	West Gulf
	Million cords	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*	*Million cords*
Softwoods:											
White, red, and jack pine	2.9	2.8	1.0	(4)	1.8	(5)	----	0.1	0.1	(5)	----
Southern yellow pine	49.0	1.6	(4)	1.0	----	0.5	0.1	47.4	13.3	22.7	11.4
Spruce-fir	3.5	3.5	2.0	(4)	1.5	----	----	----	----	----	----
Other softwoods	4.9	2.9	1.0	1.0	.7	.2	(5)	2.0	.5	1.1	.4
All softwoods	60.3	10.8	4.0	2.0	4.0	.7	.1	49.5	13.9	23.8	11.8
Hardwoods:											
Yellow-poplar	4.4	1.6	(4)	1.0	----	.6	----	2.8	1.7	1.1	(5)
Other soft hardwoods	32.1	14.8	1.0	2.0	7.7	3.2	.9	17.3	4.2	7.8	5.3
Total	36.5	16.4	1.0	3.0	7.7	3.8	.9	20.1	5.9	8.9	5.3
Oaks	35.1	16.5	1.0	5.0	1.8	8.3	.4	18.6	5.6	7.1	5.9
Beech-yellow birch-hard maple	8.7	8.1	3.0	3.0	.9	1.2	----	.6	.2	.3	.1
Other hard hardwoods	18.9	10.2	2.0	4.0	.3	3.6	.3	8.7	2.1	3.5	3.1
Total	62.7	34.8	6.0	12.0	3.0	13.1	.7	27.9	7.9	10.9	9.1
All hardwoods	99.2	51.2	7.0	15.0	10.7	16.9	1.6	48.0	13.8	19.8	14.4
All species	159.5	62.0	11.0	17.0	14.7	17.6	1.7	97.5	27.7	43.6	26.2

[1] Net annual growth in cubic feet excluding bark and in standard cords (128 cu. ft.) including bark.
[2] Less than 0.5 million cubic feet.
[3] Ponderosa pine. The total net growth of ponderosa and Jeffrey pine in the United States is 483 million cubic feet including 4 million cubic feet in the Plains Region.
[4] Less than 0.5 million cords.
[5] Less than 0.05 million cords.

TABLE 36.—*Net annual growth of growing stock on commercial forest land in Western United States and Coastal Alaska, by species group and section and region, 1952* [1]

Species group	Total, Western United States and Coastal Alaska	West							Coastal Alaska
		Total West	Pacific Northwest			California	Northern Rocky Mountain	Southern Rocky Mountain	
			Total	Douglas-fir subregion	Pine subregion				
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Softwoods:									
Douglas-fir	902	902	589	529	60	144	150	19	----------
Ponderosa and Jeffrey pine	[2] 479	[2] 479	167	8	159	99	108	105	----------
Western hemlock	237	219	208	205	3	2	9	----------	18
White and sugar pine	100	100	22	14	8	32	46	(3)	----------
Redwood	77	77	----------	----------	----------	77	----------	----------	----------
Other softwoods	833	819	286	187	99	185	278	70	14
Total	2,628	2,596	1,272	943	329	539	591	194	32
Hardwoods	149	149	55	55	----------	56	12	26	(3)
All species	2,777	2,745	1,327	998	329	595	603	220	32

[1] Net annual growth in cubic feet excluding bark.
[2] Excludes 4 million cubic feet of ponderosa pine in the Plains Region. The total net annual growth of ponderosa and Jeffrey pine in the United States is 483 million cubic feet.
[3] Less than 0.5 million cubic feet.

TABLE 37.—*Output and source of timber products in the United States and Coastal Alaska, by product and softwoods and hardwoods, 1952* [1]

Product and species group	Output from all sources				Output from roundwood						
	Standard unit	Total	From plant residues	From roundwood	All roundwood	Growing stock			Dead trees	Cull trees and limbs [2]	Other [3]
						Total	Saw-timber trees	Pole-timber trees			
Saw-logs (for lumber, timbers, sawn ties, etc.):		*Units*	*Units*	*Units*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
Softwood	M bd.-ft. lumber tally.	31,507,051	30,195	31,476,856	4,920,670	4,602,113	----------	----------	283,002	32,477	3,078
Hardwood	do	8,003,126	----------	8,003,126	1,225,293	1,198,613	----------	----------	3,394	21,391	1,895
Total		39,510,177	30,195	39,479,982	6,145,963	5,800,726	5,623,774	176,952	286,396	53,868	4,973
Veneer logs and bolts:											
Softwood	M bd.-ft. log scale.	1,548,223	----------	1,548,223	248,758	218,942	----------	----------	28,749	1,005	62
Hardwood	do	919,113	----------	919,113	173,374	172,990	----------	----------	6	368	10
Total		2,467,336	----------	2,467,336	422,132	391,932	390,649	1,283	28,755	1,373	72
Cooperage logs and bolts:											
Softwood	M bd.-ft. log scale.	117,935	----------	117,935	26,420	25,610	----------	----------	334	440	36
Hardwood	do	237,390	----------	237,390	46,527	46,318	----------	----------	----------	205	4
Total		355,325	----------	355,325	72,947	71,928	70,016	1,912	334	645	40
Pulpwood:											
Softwood	Standard cords.	21,410,653	1,399,686	20,010,967	1,550,346	1,407,194	----------	----------	26,458	107,055	9,639
Hardwood	do	3,657,126	168,070	3,489,056	272,799	248,492	----------	----------	7,550	16,468	289
Total		25,067,779	1,567,756	23,500,023	1,823,145	1,655,686	921,668	734,018	34,008	123,523	9,928
Fuelwood:											
Softwood	Standard cords.	31,065,258	24,931,050	6,134,208	475,627	231,712	----------	----------	104,034	103,621	36,260
Hardwood	do	27,536,659	6,454,091	21,082,568	1,532,188	733,787	----------	----------	275,134	342,625	180,642
Total		58,601,917	31,385,141	27,216,776	2,007,815	965,499	500,406	465,093	379,168	446,246	216,902

See footnotes at end of table.

TABLE 37.—*Output and source of timber products in the United States and Coastal Alaska, by product and softwoods and hardwoods, 1952* [1]—Continued

Product and species group	Standard unit	Output from all sources: Total	Output from all sources: From plant residues	Output from all sources: From roundwood	Output from roundwood: All roundwood	Growing stock: Total	Growing stock: Saw-timber trees	Growing stock: Pole-timber trees	Dead trees	Cull trees and limbs [2]	Other [3]
		Units	*Units*	*Units*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
Piling:											
Softwood	M linear ft	37, 847		37, 847	25, 912	25, 900				11	1
Hardwood	do	3, 342		3, 342	2, 087	2, 068				3	16
Total		41, 189		41, 189	27, 999	27, 968	26, 993	975		14	17
Poles:											
Softwood	M pieces	6, 421		6, 421	87, 026	87, 021			1		4
Hardwood	do	55		55	611	590					21
Total		6, 476		6, 476	87, 637	87, 611	78, 738	8, 873	1		25
Posts (round and split):											
Softwood	M pieces	103, 304	8	103, 296	68, 993	46, 786			5, 760	12, 210	4, 237
Hardwood	do	202, 682	92	202, 590	125, 087	80, 522			5, 384	16, 621	22, 560
Total		305, 986	100	305, 886	194, 080	127, 308	41, 296	86, 012	11, 144	28, 831	26, 797
Hewn ties:											
Softwood	M pieces	3, 701		3, 701	23, 142	22, 747			1	394	
Hardwood	do	6, 478		6, 478	44, 214	43, 833				381	
Total		10, 179		10, 179	67, 356	66, 580	65, 481	1, 099	1	775	
Mine timbers (round):											
Softwood	M cubic feet	18, 517	9	18, 508	18, 508	16, 574			1, 522	360	52
Hardwood	do	62, 452		62, 452	62, 452	55, 555			392	6, 497	8
Total		80, 969	9	80, 960	80, 960	72, 129	20, 579	51, 550	1, 914	6, 857	60
Other: [4]											
Softwood	M cubic feet	112, 306	35, 990	76, 316	76, 316	52, 923			20, 296	3, 097	
Hardwood	do	114, 697	23, 206	91, 491	91, 491	72, 310			6, 776	11, 398	1, 007
Total		227, 003	59, 196	167, 807	167, 807	125, 233	76, 731	48, 502	27, 072	14, 495	1, 007
Total, all products:											
Softwood					7, 521, 718	6, 737, 522			470, 157	260, 670	53, 369
Hardwood					3, 576, 123	2, 655, 078			298, 636	415, 957	206, 452
Total					11, 097, 841	9, 392, 600	7, 816, 331	1, 576, 269	768, 793	676, 627	259, 821

[1] Output from roundwood is shown both in cubic feet roundwood, excluding bark, and in units of measure commonly used by the Bureau of the Census, the trade, or other agencies reporting output of various products, i. e., saw logs for lumber, timbers, sawn ties, etc., in board-feet lumber tally; veneer and cooperage logs and bolts, in board-feet log scale; pulpwood and fuelwood, in standard cords (128 cu. ft.) including bark, etc. Output from plant residues and total output from all sources are shown in units commonly used for various products.

[2] In addition to cull trees and limbs includes for some products trees of commercial species less than 5.0 inches in diameter and tops less than 4.0 inches in diameter.

[3] Trees on noncommercial forest land, fence rows, stream margins, orchards, etc.

[4] Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and bolts for other such miscellaneous products.

TABLE 38.—*Timber products output in the United States and Coastal Alaska, by product, section and region of origin, and softwoods and hardwoods, 1952* [1]

Section, region, and species group	Saw logs (for lumber, etc.)	Veneer logs and bolts	Cooperage logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other
	Thousand bd.-ft.	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Number cords*	*Number cords*	*Thousand linear feet*	*Thousand picees*	*Thousand pieces*	*Thousand pieces*	*Thousand cu. ft.*	*Thousand cu. ft.*
North:											
New England:											
Softwood	1, 060, 487	2	15, 310	1, 943, 401	570, 041	355	17	2, 130			274
Hardwood	287, 310	66, 451	532	464, 141	846, 680	130		760			1, 552
Total	1, 347, 797	66, 453	15, 842	2, 407, 542	1, 416, 721	485	17	2, 890			1, 826
Middle Atlantic:											
Softwood	496, 552	788		605, 169	350, 777	3, 945	6	2, 270		55	695
Hardwood	1, 164, 591	41, 045	8, 237	475, 048	2, 038, 556	2, 137		23, 218		33, 911	12, 569
Total	1, 661, 143	41, 833	8, 237	1, 080, 217	2, 389, 333	6, 082	6	25, 488		33. 966	13, 264
Lake States:											
Softwood	290, 400	339		1, 395, 344	762, 600	242	172	14, 245		4, 959	1, 401
Hardwood	715, 610	70, 105	1, 450	835, 849	3, 986, 870	431		11, 135		1, 729	24, 548
Total	1, 006, 010	70, 444	1, 450	2, 231, 193	4, 749, 470	673	172	25, 380		6, 688	25, 949
Central:											
Softwood	87, 408	327		5, 580	872		16	7, 014			465
Hardwood	1, 239, 767	52, 766	93, 972	129, 420	4, 034, 928	258		37, 256	268	18, 155	13, 413
Total	1, 327, 175	53, 093	93, 972	135, 000	4, 035, 800	258	16	44, 270	268	18, 155	13, 878
Plains:											
Softwood	10, 783			7, 706	16, 664		6	15, 157			
Hardwood	45, 556	5, 261			1, 252, 268		4	39, 443			520
Total	56, 339	5, 261		7, 706	1, 268, 932		10	54, 600			520
Total, North:											
Softwood	1, 945, 630	1, 456	15, 310	3, 957, 200	1, 700, 954	4, 542	217	40, 816		5, 014	2, 835
Hardwood	3, 452, 834	235, 628	104, 191	1, 904, 458	12, 159, 302	2, 956	4	111, 812	268	53, 795	52, 602
Total	5, 398, 464	237, 084	119, 501	5, 861, 658	13, 860, 256	7, 498	221	152, 628	268	58, 809	55, 437
South:											
South Atlantic:											
Softwood	3, 005, 343	14, 062	19, 844	3, 126, 109	4, 985, 116	4, 743	516	15, 941	141	1, 023	12, 537
Hardwood	1, 460, 484	224, 628	2, 775	627, 515	4, 518, 104	325		17, 484	430	5, 535	19, 201
Total	4, 465, 827	238, 690	22, 619	3, 753, 624	9, 503, 220	5, 068	516	33, 425	571	6, 558	31, 738
Southeast:											
Softwood	4, 510, 907	18, 690	64, 863	7, 082, 134	4, 646, 419	10, 158	2, 320	18, 699	2, 662	2, 866	9, 793
Hardwood	2, 006, 159	312, 697	81, 424	795, 214	6, 922, 792	35		45, 792	2, 030	2, 610	25, 223
Total	6, 517, 066	331, 387	146, 287	7, 877, 348	11, 569, 211	10, 193	2, 320	64, 491	4, 692	5, 476	35, 016
West Gulf:											
Softwood	2, 094, 000	4, 869		2, 764, 474	2, 922, 165	11, 460	2, 130	15, 100	890	284	5, 826
Hardwood	1, 061, 000	146, 160	49, 000	280, 028	3, 684, 012		50	26, 100	3, 750	506	16, 083
Total	3, 155, 000	151, 029	49, 000	3, 044, 502	6, 606, 177	11, 460	2, 180	41, 200	4, 640	790	21, 909
Total, South:											
Softwood	9, 610, 250	37, 621	84, 707	12, 972, 717	12, 553, 700	26, 361	4, 966	49, 740	3, 693	4, 173	28, 156
Hardwood	4, 527, 643	683, 485	133, 199	1, 702, 757	15, 124, 908	360	50	89, 376	6, 210	8, 651	60, 507
Total	14, 137, 893	721, 106	217, 906	14, 675, 474	27, 678, 608	26, 721	5, 016	139, 116	9, 903	12, 824	88, 663

See footnotes at end of table.

TABLE 38.—*Timber products output in the United States and Coastal Alaska, by product, section and region of origin, and softwoods and hardwoods, 1952* [1]—Continued

Section, region, and species group	Saw logs (for lumber, etc.)	Veneer logs and bolts	Cooperage logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other
West:											
Pacific Northwest:	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Number cords*	*Number cords*	*Thousand linear feet*	*Thousand pieces*	*Thousand pieces*	*Thousand pieces*	*Thousand cu. ft.*	*Thousand cu. ft.*
Douglas-fir subregion:											
Softwood	10,503,169	1,216,791	13,388	3,827,568	10,519,817	5,500	475	1,695		163	59,411
Hardwood	21,199			47,936	7,662			67			60
Total	10,524,368	1,216,791	13,388	3,875,504	10,527,479	5,500	475	1,762		163	59,471
Pine subregion:											
Softwood	1,951,628	12,963		71,302	2,186,658		104	4,463		430	4,523
Hardwood				235							
Total	1,951,628	12,963		71,537	2,186,658		104	4,463		430	4,523
Total, Pacific Northwest:											
Softwood	12,454,797	1,229,754	13,388	3,898,870	12,706,475	5,500	579	6,158		593	63,934
Hardwood	21,199			48,171	7,662			67			60
Total	12,475,996	1,229,754	13,388	3,947,041	12,714,137	5,500	579	6,225		593	63,994
California:											
Softwood	4,902,411	270,842	4,530	269,243	2,330,823	1,090	45	2,000	8	455	10,211
Hardwood	600			52	34,000	26		1,400		(2)	560
Total	4,903,011	270,842	4,530	269,295	2,364,823	1,116	45	3,400	8	455	10,771
Northern Rocky Mountain:											
Softwood	1,964,810	8,525		295,275	1,046,188	21	480	3,301		6,374	3,966
Hardwood	185			1,688	22,245			1		2	
Total	1,964,995	8,525		296,963	1,068,433	21	480	3,302		6,376	3,966
Southern Rocky Mountain:											
Softwood	555,333			14,502	673,444	16	134	1,271		1,908	3,174
Hardwood	665				187,042		1	26		4	968
Total	555,998			14,502	860,486	16	135	1,297		1,912	4,142
Total, West:											
Softwood	19,877,351	1,509,121	17,918	4,477,890	16,756,930	6,627	1,238	12,730	8	9,330	81,285
Hardwood	22,649			49,911	250,949	26	1	1,494		6	1,588
Total	19,900,000	1,509,121	17,918	4,527,801	17,007,879	6,653	1,239	14,224	8	9,336	82,873
United States:											
Softwood	31,433,231	1,548,198	117,935	21,407,807	31,011,584	37,530	6,421	103,286	3,701	18,517	112,276
Hardwood	8,003,126	919,113	237,390	3,657,126	27,535,159	3,342	55	202,682	6,478	62,452	114,697
Total	39,436,357	2,467,311	355,325	25,064,933	58,546,743	40,872	6,476	305,968	10,179	80,969	226,973
Coastal Alaska:											
Softwood	73,820	25		2,846	53,674	317	(3)	18			30
Hardwood					1,500						
Total	73,820	25		2,846	55,174	317	(3)	18			30
All regions:											
Softwood	31,507,051	1,548,223	117,935	21,410,653	31,065,258	37,847	6,421	103,304	3,701	18,517	112,306
Hardwood	8,003,126	919,113	237,390	3,657,126	27,536,659	3,342	55	202,682	6,478	62,452	114,697
Total	39,510,177	2,467,336	355,325	25,067,779	58,601,917	41,189	6,476	305,986	10,179	80,969	227,003

[1] Estimates of timber products output include both roundwood and plant residues. The output from roundwood is according to sections and regions where the logs, bolts, and other round timbers cut for various products originated, and not necessarily where they were processed into lumber, pulp, veneer or other manufactured products or used in round form as poles, piling, posts, etc. The volume of plant residues such as used for fuelwood or chipped for pulp is, however, according to sections and regions where used.

Volumes are in units of measure commonly used by the Bureau of the Census, the trade, or other agencies reporting volume of output, i. e., saw logs for lumber, timbers, sawn ties, etc., in board-feet lumber tally; veneer and cooperage logs and bolts, in board-feet log scale; pulpwood and fuelwood, in standard cords (128 cu. ft.) including bark, etc. Volumes for mine timbers and "all other products," including box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, etc., are shown in cubic feet excluding bark.

[2] Less than 0.5 thousand cubic feet.

[3] Less than 0.5 thousand pieces.

TABLE 39.—*Timber products output from roundwood and plant residues in the United States and Coastal Alaska, by section, region of origin, and softwoods and hardwoods, 1952* [1]

Section, region, and species group	Saw logs (for lumber, etc.)			Veneer logs and bolts, roundwood	Pulpwood			Fuelwood			All other products		
	Total	Plant residues	Roundwood		Total	Plant residues	Roundwood	Total	Plant residues	Roundwood	Total	Plant residues	Roundwood
	Thousand bd.-ft.	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Number cords*	*Number cords*	*Number cords*	*Number cords*	*Number cords*	*Number cords*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
North:													
New England:													
Softwood	1, 060, 487	--------	1, 060, 487	2	1, 943, 401	--------	1, 943, 401	570, 041	504, 607	65, 434	6, 208	140	6, 068
Hardwood	287, 310	--------	287, 310	66, 451	464, 141	6, 442	457, 699	846, 680	205, 689	640, 991	2, 348	562	1, 786
Total	1, 347, 797	--------	1, 347. 797	66, 453	2, 407. 542	6, 442	2, 401, 100	1, 416, 721	710, 296	706, 425	8, 556	702	7, 854
Middle Atlantic:													
Softwood	496, 552	--------	496, 552	788	605, 169	--------	605, 169	350, 777	284, 153	66, 624	5, 046	--------	5, 046
Hardwood	1, 164, 591	--------	1, 164, 591	41, 045	475, 048	3, 800	471, 248	2, 038, 556	548, 882	1, 489, 674	64, 100	4, 773	59, 327
Total	1, 661, 143	--------	1, 661, 143	41, 833	1, 080, 217	3, 800	1, 076, 417	2, 389, 333	833, 035	1, 556, 298	69, 146	4, 773	64, 373
Lake States:													
Softwood	290, 400	--------	290, 400	339	1, 395, 344	5, 714	1, 389, 630	762, 600	337, 083	425, 517	18, 684	--------	18, 684
Hardwood	715, 610	--------	715, 610	70, 105	835, 849	6, 771	829, 078	3, 986, 870	568, 449	3, 418, 421	35, 166	6, 500	28, 666
Total	1, 006, 010	--------	1, 006, 010	70, 444	2, 231, 193	12, 485	2, 218, 708	4, 749, 470	905, 532	3, 843, 938	53, 850	6, 500	47, 350
Central:													
Softwood	87, 408	--------	87, 408	327	5, 580	--------	5, 580	872	--------	872	5, 201	157	5, 044
Hardwood	1, 239, 767	--------	1, 239, 767	52, 766	129, 420	6, 643	122, 777	4, 034, 928	620, 325	3, 414, 603	74, 712	4, 526	70, 186
Total	1, 327, 175	--------	1, 327, 175	53, 093	135, 000	6, 643	128, 357	4, 035, 800	620, 325	3, 415, 475	79, 913	4, 683	75, 230
Plains:													
Softwood	10, 783	--------	10. 783	--------	7, 706	--------	7, 706	16, 664	1, 875	14, 789	6, 142	--------	6, 142
Hardwood	45, 556	--------	45, 556	5, 261	--------	--------	--------	1, 252, 268	21, 987	1, 230, 281	17, 526	99	17, 427
Total	56, 339	--------	56, 339	5, 261	7, 706	--------	7, 706	1, 268, 932	23, 862	1, 245, 070	23, 668	99	23, 569
Total, North:													
Softwood	1, 945, 630	--------	1, 945, 630	1, 456	3, 957, 200	5, 714	3, 951, 486	1, 700, 954	1, 127, 718	573, 236	41, 281	297	40, 984
Hardwood	3, 452, 834	--------	3, 452, 834	235, 628	1, 904, 458	23, 656	1, 880, 802	12, 159, 302	1, 965, 332	10, 193, 970	193, 852	16, 460	177, 392
Total	5, 398, 464	--------	5, 398, 464	237, 084	5, 861, 658	29, 370	5, 832, 288	13, 860, 256	3, 093, 050	10, 767, 206	235, 133	16, 757	218, 376
South:													
South Atlantic:													
Softwood	3, 005, 343	--------	3, 005, 343	14, 062	3, 126, 109	8, 829	3, 117, 280	4, 985, 116	2, 458, 651	2, 526, 465	39, 427	1, 564	37, 863
Hardwood	1, 460, 484	--------	1, 460, 484	224, 628	627, 515	76, 843	550, 672	4, 518, 104	1, 483, 287	3, 034, 817	39, 536	1, 889	37, 647
Total	4, 465, 827	--------	4, 465, 827	238, 690	3, 753, 624	85, 672	3, 667, 952	9, 503, 220	3, 941, 938	5, 561, 282	78, 963	3, 453	75, 510
Southeast:													
Softwood	4, 510, 907	--------	4, 510, 907	18, 690	7, 082, 134	6, 271	7, 075, 863	4, 646, 419	3, 261, 071	1, 385, 348	92, 301	2, 636	89, 665
Hardwood	2, 006, 159	--------	2, 006, 159	312, 697	795, 214	50, 328	744, 886	6, 922, 792	1, 826, 807	5, 095, 985	88, 589	3, 549	85, 040
Total	6, 517, 066	--------	6, 517, 066	331, 387	7, 877, 348	56, 599	7, 820, 749	11, 569, 211	5, 087, 878	6, 481, 333	180, 890	6, 185	174, 705
West Gulf:													
Softwood	2, 094, 000	--------	2, 094, 000	4, 869	2, 764, 474	6, 858	2, 757, 616	2, 922, 165	2, 512, 238	409, 927	55, 221	3, 266	51, 955
Hardwood	1, 061, 000	--------	1, 061, 000	146, 160	280, 028	16, 943	263, 085	3. 684, 012	1, 178, 665	2, 505, 347	70, 753	1, 453	69, 300
Total	3, 155, 000	--------	3, 155, 000	151, 029	3, 044, 502	23, 801	3, 020, 701	6, 606, 177	3, 690, 903	2, 915, 274	125, 974	4, 719	121, 255
Total, South:													
Softwood	9, 610, 250	--------	9, 610, 250	37, 621	12, 972, 717	21, 958	12, 950, 759	12, 553, 700	8, 231, 960	4, 321, 740	186, 949	7, 466	179, 483
Hardwood	4, 527, 643	--------	4, 527, 643	683, 485	1, 702, 757	144, 114	1, 558, 643	15, 124, 908	4, 488, 759	10, 636, 149	198, 878	6, 891	191, 987
Total	14, 137, 893	--------	14, 137, 893	721, 106	14, 675, 474	166, 072	14, 509, 402	27, 678, 608	12, 720, 719	14, 957, 889	385, 827	14, 357	371, 470

See footnote at end of table.

TABLE 39.—*Timber products output from roundwood and plant residues in the United States and Coastal Alaska, by section, region of origin, and softwoods and hardwoods, 1952* [1]—Continued

Section, region, and species group	Saw logs (for lumber, etc.)			Veneer logs and bolts, roundwood	Pulpwood			Fuelwood			All other products		
	Total	Plant residues	Roundwood		Total	Plant residues	Roundwood	Total	Plant residues	Roundwood	Total	Plant residues	Roundwood
West:													
Pacific Northwest:													
Douglas-fir subregion:	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Number cords*	*Number cords*	*Number cords*	*Number cords*	*Number cords*	*Number cords*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
Softwood	10, 503, 169	23, 110	10, 480, 059	1, 216, 791	3, 827, 568	1, 167, 071	2, 660, 497	10, 519, 817	9, 971, 861	547, 956	77, 348	11, 995	65, 353
Hardwood	21, 199		21, 199		47, 936	300	47, 636	7, 662		7, 662	113		113
Total	10, 524, 368	23, 110	10, 501, 258	1, 216, 791	3, 875, 504	1, 167, 371	2, 708, 133	10, 527, 479	9, 971, 861	555, 618	77, 461	11, 995	65, 466
Pine subregion:													
Softwood	1, 951, 628		1, 951, 628	12, 963	71, 302	8, 486	62, 816	2, 186, 658	2, 048, 623	138, 035	10, 703	4, 317	6, 386
Hardwood					235		235						
Total	1, 951, 628		1, 951, 628	12, 963	71, 537	8, 486	63, 051	2, 186, 658	2, 048, 623	138, 035	10, 703	4, 317	6, 386
Total, Pacific Northwest:													
Softwood	12, 454, 797	23, 110	12, 431, 687	1, 229, 754	3, 898, 870	1, 175, 557	2, 723, 313	12, 706, 475	12, 020, 484	685, 991	88, 051	16, 312	71, 739
Hardwood	21, 199		21, 199		48, 171	300	47, 871	7, 662		7, 662	113		113
Total	12, 475, 996	23, 110	12, 452, 886	1, 229, 754	3, 947, 041	1, 175, 857	2, 771, 184	12, 714, 137	12, 020, 484	693, 653	88, 164	16, 312	71, 852
California:													
Softwood	4, 902, 411	7, 085	4, 895, 326	270, 842	269, 243	113, 857	155, 386	2, 330, 823	2, 311, 372	19, 451	16, 442	7, 927	8, 515
Hardwood	600		600		52		52	34, 000		34, 000	1, 976		1, 976
Total	4, 903, 011	7, 085	4, 895, 926	270, 842	269, 295	113, 857	155, 438	2, 364, 823	2, 311, 372	53, 451	18, 418	7, 927	10, 491
Northern Rocky Mountain:													
Softwood	1, 964, 810		1, 964, 810	8, 525	295, 275	82, 600	212, 675	1, 046, 188	909, 914	136, 274	21, 414	1, 479	19, 935
Hardwood	185		185		1, 688		1, 688	22, 245		22, 245	3		3
Total	1, 964, 995		1, 964, 995	8, 525	296, 963	82, 600	214, 363	1, 068, 433	909, 914	158, 519	21, 417	1, 479	19, 938
Southern Rocky Mountain:													
Softwood	555, 333		555, 333		14, 502		14, 502	673, 444	277, 864	395, 580	7, 972	2, 502	5, 470
Hardwood	665		665					187, 042		187, 042	998		998
Total	555, 998		555, 998		14, 502		14, 502	860, 486	277, 864	582, 622	8, 970	2, 502	6, 468
Total, West:													
Softwood	19, 877, 351	30, 195	19, 847, 156	1, 509, 121	4, 477, 890	1, 372, 014	3, 105, 876	16, 756, 930	15, 519, 634	1, 237, 296	133, 879	28, 220	105, 659
Hardwood	22, 649		22, 649		49, 911	300	49, 611	250, 949		250, 949	3, 090		3, 090
Total	19, 900, 000	30, 195	19, 869, 805	1, 509, 121	4, 527, 801	1, 372, 314	3, 155, 487	17, 007, 879	15, 519, 634	1, 488, 245	136, 969	28, 220	108, 749
United States:													
Softwood	31, 433, 231	30, 195	31, 403, 036	1, 548, 198	21, 407, 807	1, 399, 686	20, 008, 121	31, 011, 584	24, 879, 312	6, 132, 272	362, 109	35, 983	326, 126
Hardwood	8, 003, 126		8, 003, 126	919, 113	3, 657, 126	168, 070	3, 489, 056	27, 535, 159	6, 454, 091	21, 081, 068	395, 820	23, 351	372, 469
Total	39, 436, 357	30, 195	39, 406, 162	2, 467, 311	25, 064, 933	1, 567, 756	23, 497, 177	58, 546, 743	31, 333, 403	27, 213, 340	757, 929	59, 334	698, 595
Coastal Alaska:													
Softwood	73, 820		73, 820	25	2, 846		2, 846	53, 674	51, 738	1, 936	221	30	191
Hardwood								1, 500		1, 500			
Total	73, 820		73, 820	25	2, 846		2, 846	55, 174	51, 738	3, 436	221	30	191
All regions:													
Softwood	31, 507, 051	30, 195	31, 476, 856	1, 548, 223	21, 410, 653	1, 399, 686	20, 010, 967	31, 065, 258	24, 931, 050	6, 134, 208	362, 330	36, 013	326, 317
Hardwood	8, 003, 126		8, 003, 126	919, 113	3, 657, 126	168, 070	3, 489, 056	27, 536, 659	6, 454, 091	21, 082, 568	395, 820	23, 351	372, 469
Total	39, 510, 177	30, 195	39, 479, 982	2, 467, 336	25, 067, 779	1, 567, 756	23, 500, 023	58, 601, 917	31, 385, 141	27, 216, 776	758, 150	59, 364	698, 786

[1] Timber products output from roundwood is according to regions and sections where the logs, bolts, and other round timbers cut for various products originated, and not necessarily where they were processed into lumber, pulp, veneer or other manufactured products or used in round form as poles, piling, posts, etc. The volume of plant residues such as used for fuelwood or chipped for pulp is, however, according to regions and sections where used.

Volumes are in units of measure commonly used by the Bureau of the Census, the trade, or other agencies in reporting volume of output, i. e., saw logs for lumber, timbers, sawn ties, etc., in board-feet lumber tally; veneer logs and bolts, in board-feet log scale; and pulpwood and fuelwood, in standard cords (128 cu. ft.) including bark. Volumes for all other products including cooperage logs and bolts, poles, and piling, posts, hewn ties, mine timbers and various miscellaneous products like box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, etc., are shown in cubic feet excluding bark. Except for a few posts and mine timbers within this group, plant residues are used exclusively for excelsior, chemical wood, and other such miscellaneous products.

TABLE 40.—*Timber products output from roundwood in the United States and Coastal Alaska, by section, region of origin, and softwoods and hardwoods, 1952* [1]

Section, region, and species group	Total, all products	Saw logs (for lumber, etc.)	Veneer logs and bolts	Cooperage logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other [2]
	Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
North:												
New England:												
Softwood	348, 981	183, 695	(3)	3, 597	155, 473	3, 745	213	179	1, 945	---	---	134
Hardwood	149, 913	50, 147	11, 012	101	36, 673	50, 295	78	---	617	---	---	990
Total	498, 894	233, 842	11, 012	3, 698	192, 146	54, 040	291	179	2, 562	---	---	1, 124
Middle Atlantic:												
Softwood	140, 558	81, 720	133	---	48, 420	5, 239	2, 494	76	1, 726	---	55	695
Hardwood	401, 852	179, 155	6, 663	1, 343	37, 746	118, 961	1, 283	---	14, 994	---	33, 911	7, 796
Total	542, 410	260, 875	6, 796	1, 343	86, 166	124, 200	3, 777	76	16, 720	---	33, 966	8, 491
Lake States:												
Softwood	201, 754	48, 207	59	---	108, 627	26, 177	170	1, 469	10, 685	---	4, 959	1, 401
Hardwood	448, 217	113, 269	11, 091	236	63, 220	231, 971	302	---	8, 351	---	1, 729	18, 048
Total	649, 971	161, 476	11, 150	236	171, 847	258, 148	472	1, 469	19, 036	---	6, 688	19, 449
Central:												
Softwood	17, 518	12, 040	57	---	322	55	---	64	4, 672	---	---	308
Hardwood	458, 772	165, 840	9, 209	16, 852	7, 690	205, 847	159	---	24, 652	1, 337	18, 155	9, 031
Total	476, 290	177, 880	9, 266	16, 852	8, 012	205, 902	159	64	29, 324	1, 337	18, 155	9, 339
Plains:												
Softwood	9, 711	1, 790	---		578	1, 201	---	20	6, 122		---	
Hardwood	114, 512	6, 673	957	---	---	89, 455	---	16	16, 990	---	---	421
Total	124, 223	8, 463	957	---	578	90, 656	---	36	23, 112	---	---	421
Total, North:												
Softwood	718, 522	327, 452	249	3, 597	313, 420	36, 417	2, 877	1, 808	25, 150	---	5, 014	2, 538
Hardwood	1, 573, 266	515, 084	38, 932	18, 532	145, 329	696, 529	1, 822	16	65, 604	1, 337	53, 795	36, 286
Total	2, 291, 788	842, 536	39, 181	22, 129	458, 749	732, 946	4, 699	1, 824	90, 754	1, 337	58, 809	38, 824
South:												
South Atlantic:												
Softwood	936, 651	486, 866	2, 902	4, 921	218, 694	190, 326	3, 235	6, 398	10, 474	839	1, 023	10, 973
Hardwood	565, 203	224, 622	46, 156	533	44, 013	212, 765	222	---	11, 487	2, 558	5, 535	17, 312
Total	1, 501, 854	711, 488	49, 058	5, 454	262, 707	403, 091	3, 457	6, 398	21, 961	3, 397	6, 558	28, 285
Southeast:												
Softwood	1, 460, 096	743, 138	3, 684	15, 064	511, 255	112, 354	6, 888	30, 474	11, 170	16, 032	2, 866	7, 171
Hardwood	906, 447	314, 747	61, 257	17, 073	58, 391	387, 012	27	---	29, 661	13, 994	2, 610	21, 675
Total	2, 366, 543	1, 057, 885	64, 941	32, 137	569, 646	499, 366	6, 915	30, 474	40, 831	30, 026	5, 476	28, 846
West Gulf:												
Softwood	640, 985	351, 792	900	---	206, 857	29, 481	7, 770	25, 340	9, 754	6, 247	284	2, 560
Hardwood	501, 959	167, 638	27, 029	10, 389	20, 642	217, 350	---	590	16, 860	26, 325	506	14, 630
Total	1, 142, 944	519, 430	27, 929	10, 389	227, 499	246, 831	7, 770	25, 930	26, 614	32, 572	790	17, 190
Total, South:												
Softwood	3, 037, 732	1, 581, 796	7, 486	19, 985	936, 806	332, 161	17, 893	62, 212	31, 398	23, 118	4, 173	20, 704
Hardwood	1, 973, 609	707, 007	134, 442	27, 995	123, 046	817, 127	249	590	58, 008	42, 877	8, 651	53, 617
Total	5, 011, 341	2, 288, 803	141, 928	47, 980	1, 059, 852	1, 149, 288	18, 142	62, 802	89, 406	65, 995	12, 824	74, 321

See footnotes at end of table.

TABLE 40.—*Timber products output from roundwood in the United States and Coastal Alaska, by section, region of origin, and softwoods and hardwoods, 1952* [1]—Continued

Section, region, and species group	Total, all products	Saw logs (for lumber, etc.)	Veneer logs and bolts	Cooperage logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other [2]
West:												
Pacific Northwest:	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
Douglas-fir subregion:												
Softwood	2, 177, 818	1, 602, 403	200, 955	2, 231	259, 399	49, 708	4, 234	9, 952	1, 357		154	47, 425
Hardwood	8, 029	2, 971			4, 263	682			53			60
Total	2, 185, 847	1, 605, 374	200, 955	2, 231	263, 662	50, 390	4, 234	9, 952	1, 410		154	47, 485
Pine subregion:												
Softwood	344, 326	317, 161	2, 141		6, 165	12, 473		2, 179	3, 571		430	206
Hardwood	21				21							
Total	344, 347	317, 161	2, 141		6, 186	12, 473		2, 179	3, 571		430	206
Total, Pacific Northwest:												
Softwood	2, 522, 144	1, 919, 564	203, 096	2, 231	265, 564	62, 181	4, 234	12, 131	4, 928		584	47, 631
Hardwood	8, 050	2, 971			4, 284	682			53			60
Total	2, 530, 194	1, 922, 535	203, 096	2, 231	269, 848	62, 863	4, 234	12, 131	4, 981		584	47, 691
California:												
Softwood	796, 972	733, 945	36, 571	607	16, 001	1, 940	727	1, 018	3, 400	24	455	2, 284
Hardwood	4, 791	90			5	2, 720	16		1, 400		(3)	560
Total	801, 763	734, 035	36, 571	607	16, 006	4, 660	743	1, 018	4, 800	24	455	2, 844
Northern Rocky Mountain:												
Softwood	313, 189	264, 124	1, 352		17, 029	10, 749	10	8, 179	2, 885		6, 374	2, 487
Hardwood	1, 928	31			135	1, 759			1		2	
Total	315, 117	264, 155	1, 352		17, 164	12, 508	10	8, 179	2, 886		6, 376	2, 487
Southern Rocky Mountain:												
Softwood	122, 543	83, 769			1, 305	31, 999	5	1, 669	1, 216		1, 908	672
Hardwood	14, 344	110				13, 236		5	21		4	968
Total	136, 887	83, 879			1, 305	45, 235	5	1, 674	1, 237		1, 912	1, 640
Total, West:												
Softwood	3, 754, 848	3, 001, 402	241, 019	2, 838	299, 899	106, 869	4, 976	22, 997	12, 429	24	9, 321	53, 074
Hardwood	29, 113	3, 202			4, 424	18, 397	16	5	1, 475		6	1, 588
Total	3, 783, 961	3, 004, 604	241, 019	2, 838	304, 323	125, 266	4, 992	23, 002	13, 904	24	9, 327	54, 662
United States:												
Softwood	7, 511, 102	4, 910, 650	248, 754	26, 420	1, 550, 125	475, 447	25, 746	87, 017	68, 977	23, 142	18, 508	76, 316
Hardwood	3, 575, 988	1, 225, 293	173, 374	46, 527	272, 799	1, 532, 053	2, 087	611	125, 087	44, 214	62, 452	91, 491
Total	11, 087, 090	6, 135, 943	422, 128	72, 947	1, 822, 924	2, 007, 500	27, 833	87, 628	194, 064	67, 356	80, 960	167, 807
Coastal Alaska:												
Softwood	10, 616	10, 020	4		221	180	166	9	16			
Hardwood	135					135						
Total	10, 751	10, 020	4		221	315	166	9	16			
All regions:												
Softwood	7, 521, 718	4, 920, 670	248, 758	26, 420	1, 550, 346	475, 627	25, 912	87, 026	68, 993	23, 142	18, 508	76, 316
Hardwood	3, 576, 123	1, 225, 293	173, 374	46, 527	272, 799	1, 532, 188	2, 087	611	125, 087	44, 214	62, 452	91, 491
Total	11, 097, 841	6, 145, 963	422, 132	72, 947	1, 823, 145	2, 007, 815	27, 999	87, 637	194, 080	67, 356	80, 960	167, 807

[1] Output from roundwood is according to regions and sections where the logs, bolts, and other round timbers cut for various products originated, and not necessarily where they were processed into lumber, veneer, pulp or other manufactured products or used in round form as poles, piling, posts, etc. Volumes are in cubic feet roundwood excluding bark.

[2] Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and bolts for other such miscellaneous products.

[3] Less than 0.5 thousand cubic feet.

TABLE 41.—*Timber products output from growing stock on commercial forest land in the United States and Coastal Alaska, by section, region of origin, and softwoods and hardwoods, 1952* [1]

Section, region, and species group	Total, all products	Saw logs (for lumber, etc.)	Veneer logs and bolts	Cooperage logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other [2]
North:	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
New England:												
Softwood	331,050	174,254	----	3,471	148,777	2,213	213	179	1,816	----	----	127
Hardwood	123,878	47,679	10,991	98	34,730	28,783	78	----	567	----	----	952
Total	454,928	221,933	10,991	3,569	183,507	30,996	291	179	2,383	----	----	1,079
Middle Atlantic:												
Softwood	118,149	76,084	132	----	35,388	2,120	2,482	76	1,137	----	49	681
Hardwood	293,327	168,938	6,592	1,325	34,644	34,895	1,280	----	11,479	----	27,438	6,736
Total	411,476	245,022	6,724	1,325	70,032	37,015	3,762	76	12,616	----	27,487	7.417
Lake States:												
Softwood	169,703	47,482	59	----	100,787	6,584	170	1,469	7,868	----	3,919	1,365
Hardwood	304,379	110,348	11,088	236	62,581	97,076	302	----	6,686	----	1,554	14,508
Total	474,082	157,830	11,147	236	163,368	103,660	472	1,469	14,554	----	5,473	15,873
Central:												
Softwood	16,867	12,040	57	----	322	55	----	64	4,188	----	----	141
Hardwood	345,147	165,840	9,209	16,852	7,482	102,800	159	----	16,717	1,337	18,155	6,596
Total	362,014	177,880	9,266	16,852	7,804	102,855	159	64	20,905	1,337	18,155	6,737
Plains:												
Softwood	3,702	1,780	----	----	488	146	----	17	1,271	----	----	----
Hardwood	20,975	6,573	956	----	----	9,728	----	----	3,639	----	----	79
Total	24,677	8,353	956	----	488	9,874	----	17	4,910	----	----	79
Total, North:												
Softwood	639,471	311,640	248	3,471	285,762	11,118	2,865	1,805	16,280	----	3,968	2,314
Hardwood	1,087,706	499,378	38,836	18,511	139,437	273,282	1,819	----	39,088	1,337	47,147	28,871
Total	1,727,177	811,018	39,084	21,982	425,199	284,400	4,684	1,805	55,368	1,337	51,115	31,185
South:												
South Atlantic:												
Softwood	838,201	485,063	2,902	4,921	206,267	110,692	3,235	6,398	6,535	818	1,023	10,347
Hardwood	424,285	222,285	46,156	533	37,981	89,214	222	----	7,168	2,492	5,292	12,942
Total	1,262,486	707,348	49,058	5,454	244,248	199,906	3,457	6,398	13,703	3,310	6,315	23,289
Southeast:												
Softwood	1,356,194	739,607	3,684	14,937	459,294	68,768	6,888	30,474	7,137	15,660	2,866	6,879
Hardwood	720,748	309,471	61,114	17,003	48,514	227,999	27	----	21,584	13,867	2,610	18,559
Total	2,076,942	1,049,078	64,798	31,940	507,808	296,767	6,915	30,474	28,721	29,527	5,476	25.438
West Gulf:												
Softwood	596,464	349,698	900	----	174,586	20,440	7,770	25,340	8,779	6,247	284	2,420
Hardwood	411,856	164,455	26,884	10,271	18,180	141,278	----	590	12,645	26,137	506	10,910
Total	1,008,320	514,153	27,784	10,271	192,766	161,718	7,770	25,930	21,424	32,384	790	13,330
Total, South:												
Softwood	2,790,859	1,574,368	7,486	19,858	840,147	199,900	17,893	62,212	22,451	22,725	4,173	19,646
Hardwood	1,556,889	696,211	134,154	27,807	104,675	458,491	249	590	41,397	42,496	8,408	42,411
Total	4,347,748	2,270,579	141,640	47,665	944,822	658,391	18,142	62,802	63,848	65,221	12,581	62,057

See footnotes at end of table.

TABLE 41.—*Timber products output from growing stock on commercial forest land in the United States and Coastal Alaska, by section, region of origin, and softwoods and hardwoods, 1952* [1]—Continued

Section, region, and species group	Total, all products	Saw logs (for lumber, etc.)	Veneer logs and bolts	Cooperage logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other [2]
West:												
Pacific Northwest:	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
Douglas-fir subregion:												
Softwood	1,830,807	1,352,524	171,202	1,674	249,857	14,282	4,234	9,952	935	--	154	25,993
Hardwood	7,891	2,868	--	--	4,244	682	--	--	37	--	--	60
Total	1,838,698	1,355,392	171,202	1,674	254,101	14,964	4,234	9,952	972	--	154	26,053
Pine subregion:												
Softwood	320,645	304,354	2,141	--	6,066	3,143	--	2,179	2,175	--	422	165
Hardwood	20	--	--	--	20	--	--	--	--	--	--	--
Total	320,665	304,354	2,141	--	6,086	3,143	--	2,179	2,175	--	422	165
Total, Pacific Northwest:												
Softwood	2,151,452	1,656,878	173,343	1,674	255,923	17,425	4,234	12,131	3,110	--	576	26,158
Hardwood	7,911	2,868	--	--	4,264	682	--	--	37	--	--	60
Total	2,159,363	1,659,746	173,343	1,674	260,187	18,107	4,234	12,131	3,147	--	576	26,218
California:												
Softwood	764,755	711,703	36,509	607	9,025	540	727	1,018	2,400	22	410	1,794
Hardwood	75	15	--	--	--	60	--	--	--	--	(3)	--
Total	764,830	711,718	36,509	607	9,025	600	727	1,018	2,400	22	410	1,794
Northern Rocky Mountain:												
Softwood	294,775	256,586	1,352	--	16,116	2,222	10	8,179	2,161	--	5,808	2,341
Hardwood	1,236	31	--	--	116	1,089	--	--	--	--	(3)	--
Total	296,011	256,617	1,352	--	16,232	3,311	10	8,179	2,161	--	5,808	2,341
Southern Rocky Mountain:												
Softwood	85,966	81,118	--	--	--	487	5	1,667	380	--	1,639	670
Hardwood	1,261	110	--	--	--	183	--	--	--	--	--	968
Total	87,227	81,228	--	--	--	670	5	1,667	380	--	1,639	1,638
Total, West:												
Softwood	3,296,948	2,706,285	211,204	2,281	281,064	20,674	4,976	22,995	8,051	22	8,433	30,963
Hardwood	10,483	3,024	--	--	4,380	2,014	--	--	37	--	(3)	1,028
Total	3,307,431	2,709,309	211,204	2,281	285,444	22,688	4,976	22,995	8,088	22	8,433	31,991
United States:												
Softwood	6,727,278	4,592,293	218,938	25,610	1,406,973	231,692	25,734	87,012	46,782	22,747	16,574	52,923
Hardwood	2,655,078	1,198,613	172,990	46,318	248,492	733,787	2,068	590	80,522	43,833	55,555	72,310
Total	9,382,356	5,790,906	391,928	71,928	1,655,465	965,479	27,802	87,602	127,304	66,580	72,129	125,233
Coastal Alaska:												
Softwood	10,244	9,820	4	--	221	20	166	9	4	--	--	--
Hardwood	--	--	--	--	--	--	--	--	--	--	--	--
Total	10,244	9,820	4	--	221	20	166	9	4	--	--	--
All regions:												
Softwood	6,737,522	4,602,113	218,942	25,610	1,407,194	231,712	25,900	87,021	46,786	22,747	16,574	52,923
Hardwood	2,655,078	1,198,613	172,990	46,318	248,492	733,787	2,068	590	80,522	43,833	55,555	72,310
Total	9,392,600	5,800,726	391,932	71,928	1,655,686	965,499	27,968	87,611	127,308	66,580	72,129	125,233

[1] Output from growing stock is according to regions and sections where the logs, bolts, and other round timbers cut from various products originated, and not necessarily where they were processed into lumber, veneer, pulp, or other manufactured products or used in round form as poles, piling, posts, etc.
Volumes are in cubic feet roundwood excluding bark.

[2] Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and other such miscellaneous products.
[3] Less than 0.5 thousand cubic feet.

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TABLE 42.—*Timber cut on commercial forest land in the United States and Coastal Alaska, by product and class of material, 1952* [1]

Product	Growing stock			Sawtimber						Poletimber		
	Total cut	Timber products	Logging residues	Total cut		Timber products		Logging residues		Total cut	Timber products	Logging residues
	Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand bd.-ft.*	*Thousand cu. ft.*	*Thousand bd.-ft.*	*Thousand cu. ft.*	*Thousand bd.-ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
Saw logs (for lumber, timbers, sawn ties, etc.	6, 820, 453	5, 800, 726	1, 019, 727	6, 565, 205	36, 636, 198	5, 623, 774	34, 534, 208	941, 431	2, 101, 990	255, 248	176, 952	78, 296
Veneer logs and bolts	491, 648	391, 932	99, 716	488, 234	2, 803, 121	390, 649	2, 562, 044	97, 585	241, 077	3, 414	1, 283	2, 131
Cooperage logs and bolts	104, 718	71, 928	32, 790	102, 367	516, 302	70, 016	447, 905	32, 351	68, 397	2, 351	1, 912	439
Pulpwood	1, 727, 498	1, 655, 686	71, 812	974, 890	4, 693, 265	921, 668	4, 607, 469	53, 222	85, 796	752, 608	734, 018	18, 590
Fuelwood	1, 004, 279	965, 499	38, 780	537, 853	2, 245, 784	500, 406	2, 217, 837	37, 447	27, 947	466, 426	465, 093	1, 333
Piling	32, 322	27, 968	4, 354	31, 274	159, 140	26, 993	151, 195	4, 281	7, 945	1, 048	975	73
Poles	101, 405	87, 611	13, 794	91, 657	469, 562	78, 738	447, 929	12, 919	21, 633	9, 748	8, 873	875
Posts (round and split)	131, 290	127, 308	3, 982	43, 959	217, 528	41, 296	211, 147	2, 663	6, 381	87, 331	86, 012	1, 319
Hewn ties	108, 536	66, 580	41, 956	106, 171	483, 021	65, 481	399, 077	40, 690	83, 944	2, 365	1, 099	1, 266
Mine timbers (round)	77, 083	72, 129	4, 954	22, 975	100, 104	20, 579	97, 241	2, 396	2, 863	54, 108	51, 550	2, 558
Other [2]	157, 541	125, 233	32, 308	103, 822	515, 804	76, 731	451, 846	27, 091	63, 958	53, 719	48, 502	5, 217
Total	10, 756, 773	9, 392, 600	1, 364, 173	9, 068, 407	48, 839, 829	7, 816, 311	46, 127, 898	1, 252, 076	2, 711, 931	1, 688, 366	1, 576, 269	112, 097

[1] Volumes refer to growing stock inventory and are in cubic feet roundwood excluding bark, and in board-feet log scale, International 1/4-inch rule: they represent the net cubic-foot volume of live sawtimber and poletimber trees from stump to minimum 4.0-inch top (of central stem) inside bark and the net board-foot volume of the saw-log part of live sawtimber trees (from stump to merchantable top) cut or killed in logging and converted to timber products or left as logging residues.

[2] Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and other such products.

TABLE 43.—*Timber cut for all products on commercial forest land in the United States and Coastal Alaska, by class of material and section and region of origin, 1952* [1]

Section and region	Growing stock			Sawtimber						Poletimber		
	Total cut	Timber products	Logging residues	Total cut		Timber products		Logging residues		Total cut	Timber products	Logging residues
	Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand bd.-ft.*	*Thousand cu. ft.*	*Thousand bd.-ft.*	*Thousand cu. ft.*	*Thousand bd.-ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
North:												
New England	500, 218	454, 928	45, 290	385, 742	1, 768, 456	351, 115	1, 669, 111	34, 627	99, 345	114, 476	103, 813	10, 663
Middle Atlantic	469, 299	411, 476	57, 823	362, 753	1, 794, 916	314, 076	1, 669, 396	48, 677	125, 520	106, 546	97, 400	9, 146
Lake States	537, 170	474, 082	63, 088	266, 389	1, 240, 407	227, 709	1, 187, 417	38, 680	52, 990	270, 781	246, 373	24, 408
Central	405, 142	362, 014	43, 128	292, 977	1, 808, 970	250, 622	1, 651, 730	42, 355	157, 240	112, 165	111, 392	773
Plains	28, 104	24, 677	3, 427	18, 376	93, 532	15, 166	88, 738	3, 210	4, 794	9, 728	9, 511	217
Total	1, 939, 933	1, 727, 177	212, 756	1, 326, 237	6, 706, 281	1, 158, 688	6, 266, 392	167, 549	439, 889	613, 696	568, 489	45, 207
South:												
South Atlantic	1, 454, 948	1, 262, 486	192, 462	1, 148, 291	5, 352, 165	971, 827	5, 140, 460	176, 464	211, 705	306, 657	290, 659	15, 998
Southeast	2, 405, 459	2, 076, 942	328, 517	1, 928, 963	9, 411, 186	1, 623, 065	9, 068, 966	305, 898	342, 220	476, 496	453, 877	22, 619
West Gulf	1, 192, 846	1, 008, 320	184, 526	963, 319	4, 835, 211	788, 400	4, 613, 860	174, 919	221, 351	229, 527	219, 920	9, 607
Total	5, 053, 253	4, 347, 748	705, 505	4, 040, 573	19, 598, 562	3, 383, 292	18, 823, 286	657, 281	775, 276	1, 012, 680	964, 456	48, 224
West:												
Pacific Northwest:												
Douglas-fir subregion	2, 031, 275	1, 838, 698	192, 577	2, 017, 837	12, 220, 815	1, 826, 571	11, 370, 748	191, 266	850, 067	13, 438	12, 127	1, 311
Pine subregion	359, 271	320, 665	38, 606	356, 071	2, 049, 861	317, 808	1, 942, 519	38, 263	107, 342	3, 200	2, 857	343
Total	2, 390, 546	2, 159, 363	231, 183	2, 373, 908	14, 270, 676	2, 144, 379	13, 313, 267	229, 529	957, 409	15, 638	14, 984	1, 654
California	931, 536	764, 830	166, 706	923, 881	5, 724, 198	764, 670	5, 262, 363	159, 211	461, 835	7, 655	160	7, 495
Northern Rocky Mountain	329, 093	296, 011	33, 082	301, 915	1, 899, 016	275, 084	1, 858, 389	26, 831	40, 627	27, 178	20, 927	6, 251
Southern Rocky Mountain	100, 040	87, 227	12, 813	89, 737	555, 004	79, 986	526, 587	9, 751	28, 417	10, 303	7, 241	3, 062
Total	3, 751, 215	3, 307, 431	443, 784	3, 689, 441	22, 448, 894	3, 264, 119	20, 960, 606	425, 322	1, 488, 288	61, 774	43, 312	18, 462
United States	10, 744, 401	9, 382, 356	1, 362, 045	9, 056, 251	48, 753, 737	7, 806, 099	46, 050, 284	1, 250, 152	2, 703, 453	1, 688, 150	1, 576, 257	111, 893
Coastal Alaska	12, 372	10, 244	2, 128	12, 156	86, 092	10, 232	77, 614	1, 924	8, 478	216	12	204
All regions	10, 756, 773	9, 392, 600	1, 364, 173	9, 068, 407	48, 839, 829	7, 816, 331	46, 127, 898	1, 252, 076	2, 711, 931	1, 688, 366	1, 576, 269	112, 097

[1] Volumes refer to growing stock inventory and are in cubic feet roundwood excluding bark, and in board-feet log scale, International 1/4-inch rule; they represent the net cubic-foot volume of live sawtimber and poletimber trees from stump to minimum 4.0-inch top (of central stem) inside bark and the net board-foot volume of the saw-log part of live sawtimber trees (from stump to merchantable top) cut or killed in logging and converted to timber products or left as logging residues.

TABLE 44.—*Timber cut for all products from live sawtimber and growing stock on commercial forest land in the United States and Coastal Alaska, by section and region of origin and softwoods and hardwoods, 1952* [1]

Section and region	Growing stock			Live sawtimber					
	Total	Softwood	Hardwood	Total		Softwood		Hardwood	
	Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand bd.-ft.*	*Thousand cu. ft.*	*Thousand bd.-ft.*	*Thousand cu. ft.*	*Thousand bd.-ft.*
North:									
New England	500, 218	361, 082	139, 136	385, 742	1, 768, 456	306, 677	1, 380, 918	79, 065	387, 538
Middle Atlantic	469, 299	129, 504	339, 795	362, 753	1, 794, 916	107, 816	507, 531	254, 937	1, 287, 385
Lake States	537, 170	188, 566	348, 604	266, 389	1, 240, 407	82, 937	383, 959	183, 452	856, 448
Central	405, 142	16, 911	388, 231	292, 977	1, 808, 970	13, 030	85, 456	279, 947	1, 723, 514
Plains	28, 104	3, 960	24, 144	18, 376	93, 532	2, 303	12, 239	16, 073	81, 293
Total	1, 939, 933	700, 023	1, 239, 910	1, 326, 237	6, 706, 281	512, 763	2, 370, 103	813, 474	4, 336, 178
South:									
South Atlantic	1, 454, 948	915, 856	539, 092	1, 148, 291	5, 352, 165	710, 652	3, 359, 933	437, 639	1, 992, 232
Southeast	2, 405, 459	1, 479, 153	926, 306	1, 928, 963	9, 411, 186	1, 152, 356	5, 724, 120	776, 607	3, 687, 066
West Gulf	1, 192, 846	651, 101	541, 745	963, 319	4, 835, 211	501, 938	2, 636, 377	461, 381	2, 198, 834
Total	5, 053, 253	3, 046, 110	2, 007, 143	4, 040, 573	19, 598, 562	2, 364, 946	11, 720, 430	1, 675, 627	7, 878, 132
West:									
Pacific Northwest:									
Douglas-fir subregion	2, 031, 275	2, 022, 525	8, 750	2, 017, 837	12, 220, 815	2, 009, 266	12, 169, 523	8, 571	51, 292
Pine subregion	359, 271	359, 249	22	356, 071	2, 049, 861	356, 049	2, 049, 718	22	143
Total	2, 390, 546	2, 381, 774	8, 772	2, 373, 908	14, 270, 676	2, 365, 315	14, 219, 241	8, 593	51, 435
California	931, 536	920, 389	11, 147	923, 881	5, 724, 198	915, 314	5, 704, 180	8, 567	20, 018
Northern Rocky Mountain	329, 093	327, 836	1, 257	301, 915	1, 899, 016	301, 531	1, 896, 823	384	2, 193
Southern Rocky Mountain	100, 040	98, 587	1, 453	89, 737	555, 004	88, 647	548, 993	1, 090	6, 011
Total	3, 751, 215	3, 728, 586	22, 629	3, 689, 441	22, 448, 894	3, 670, 807	22, 369, 237	18, 634	79, 657
United States	10, 744, 401	7, 474, 719	3, 269, 682	9, 056, 251	48, 753, 737	6, 548, 516	36, 459, 770	2, 507, 735	12, 293, 967
Coastal Alaska	12, 372	12, 372	----------	12, 156	86, 092	12, 156	86, 092	----------	----------
All regions	10, 756, 773	7, 487, 091	3, 269, 682	9, 068, 407	48, 839, 829	6, 560, 672	36, 545, 862	2, 507, 735	12, 293, 967

[1] Estimates of timber cut include logging residues as well as growing stock material removed as timber products. Volumes refer to growing stock inventory and are in cubic feet roundwood excluding bark, and in board-feet log scale, International ¼-inch rule; they represent the net cubic-foot volume of live sawtimber and poletimber trees from stump to minimum 4.0-inch top (of central stem) inside bark and the net board-foot volume of the saw-log part of live sawtimber trees (from stump to merchantable top) cut or killed in logging.

TABLE 45.—*Timber cut from live sawtimber and growing stock on commercial forest land in the United States and Coastal Alaska, by product and softwoods and hardwoods, 1952* [1]

Product	Growing stock			Live sawtimber					
	Total	Softwood	Hardwood	Total		Softwood		Hardwood	
	Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand bd.-ft.*	*Thousand cu. ft.*	*Thousand bd.-ft.*	*Thousand cu. ft.*	*Thousand bd.-ft.*
Saw logs (for lumber, timbers, sawn ties, etc.)	6, 820, 453	5, 213, 623	1, 606, 830	6, 565, 205	36, 636, 198	5, 055, 696	28, 890, 540	1, 509, 509	7, 745, 658
Veneer logs and bolts	491, 648	250, 428	241, 220	488, 234	2, 803, 121	250, 125	1, 575, 655	238, 109	1, 227, 466
Cooperage logs and bolts	104, 718	28, 944	75, 774	102, 367	516, 302	27, 029	143, 276	75, 338	373, 026
Pulpwood	1, 727, 498	1, 460, 057	267, 441	974, 890	4, 693, 265	871, 277	4, 251, 775	103, 613	441, 490
Fuelwood	1, 004, 279	243, 541	760, 738	537, 853	2, 245, 784	143, 888	595, 211	393, 965	1, 650, 573
Piling	32, 322	29, 885	2, 437	31, 274	159, 140	28, 861	147, 665	2, 413	11, 475
Poles	101, 405	100, 805	600	91, 657	469, 562	91, 059	465, 774	598	3, 788
Posts (round and split)	131, 290	49, 581	81, 709	43, 959	217, 528	14, 667	68, 771	29, 292	148, 757
Hewn ties	108, 536	31, 789	76, 747	106, 171	483, 021	31, 684	151, 781	74, 487	331, 240
Mine timbers (round)	77, 083	18, 904	58, 179	22, 975	100, 104	8, 550	40, 733	14, 425	59, 371
Other [2]	157, 541	59, 534	98, 007	103, 822	515, 804	37, 836	214, 681	65, 986	301, 123
Total	10, 756, 773	7, 487, 091	3, 269, 682	9, 068, 407	48, 839, 829	6, 560, 672	36, 545, 862	2, 507, 735	12, 293, 967

[1] Estimates of timber cut include logging residues as well as growing stock material removed as timber products. This table is similar in format to table 9 of Basic Forest Statistics for the United States, January 1945 (revised 1950 issue), but the data are not directly comparable because of changes in standards between 1945 and 1952.

Volumes refer to growing stock inventory and are in cubic feet roundwood excluding bark, and in board-feet log scale, International ¼-inch rule; they represent the net cubic-foot volume of live sawtimber and poletimber trees from stump to minimum 4.0 inch top (of central stem) inside bark and the net board-foot volume of the saw-log part of live sawtimber trees (from stump to merchantable top) cut or killed in logging.

[2] Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and other such products.

TABLE 46.—*Timber cut from live sawtimber on commercial forest land in the United States and Coastal Alaska, by product, section, region of origin, and softwoods and hardwoods, 1952*

VOLUME IN BOARD-FEET [1]

Section, region, and species group	Total, all products	Saw logs (for lumber, etc.)	Veneer logs and bolts	Cooperage logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other [2]
	Thousand bd.-ft.	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*
North:												
New England:												
Softwood	1,380,918	835,737	----	8,646	531,150	2,450	1,045	771	513	----	----	606
Hardwood	387,538	222,834	69,554	338	76,036	13,531	380	----	64	----	----	4,801
Total	1,768,456	1,058,571	69,554	8,984	607,186	15,981	1,425	771	577	----	----	5,407
Middle Atlantic:												
Softwood	507,531	393,313	873	----	93,456	5,396	12,365	340	575	----	45	1,168
Hardwood	1,287,385	1,003,490	43,409	8,818	66,503	70,520	6,508	----	18,616	----	41,886	27,635
Total	1,794,916	1,396,803	44,282	8,818	159,959	75,916	18,873	340	19,191	----	41,931	28,803
Lake States:												
Softwood	383,959	249,167	403	----	97,684	5,520	1,330	4,666	8,746	----	11,407	5,036
Hardwood	856,448	593,142	81,012	1,721	30,156	96,795	2,370	----	6,840	----	7,430	36,982
Total	1,240,407	842,309	81,415	1,721	127,840	102,315	3,700	4,666	15,586	----	18,837	42,018
Central:												
Softwood	85,456	77,696	390	----	128	130	----	285	6,827	----	----	----
Hardwood	1,723,514	1,246,062	69,844	122,858	4,676	213,463	958	----	29,730	9,108	----	26,815
Total	1,808,970	1,323,758	70,234	122,858	4,804	213,593	958	285	36,557	9,108	----	26,815
Plains:												
Softwood	12,239	10,455	----	----	689	861	----	----	234	----	----	----
Hardwood	81,293	45,586	7,306	----	----	21,872	----	----	6,338	----	----	191
Total	93,532	56,041	7,306	----	689	22,733	----	----	6,572	----	----	191
Total, North:												
Softwood	2,370,103	1,566,368	1,666	8,646	723,107	14,357	14,740	6,062	16,895	----	11,452	6,810
Hardwood	4,336,178	3,111,114	271,125	133,735	177,371	416,181	10,216	----	61,588	9,108	49,316	96,424
Total	6,706,281	4,677,482	272,791	142,381	900,478	430,538	24,956	6,062	78,483	9,108	60,768	103,234
South:												
South Atlantic:												
Softwood	3,359,933	2,587,600	16,871	29,171	520,364	121,121	15,653	31,579	6,408	5,161	1,841	24,164
Hardwood	1,992,232	1,486,772	304,305	3,803	72,400	39,651	1,074	----	7,028	16,684	10,054	50,461
Total	5,352,165	4,074,372	321,176	32,974	592,764	160,772	16,727	31,579	13,436	21,845	11,895	74,625
Southeast:												
Softwood	5,724,120	4,114,283	21,038	88,054	942,348	235,026	38,546	166,117	3,055	100,186	3,687	11,780
Hardwood	3,687,066	2,036,884	438,315	138,451	117,003	707,184	174	----	48,720	104,995	----	95,340
Total	9,411,186	6,151,167	459,353	226,505	1,059,351	942,210	38,720	166,117	51,775	205,181	3,687	107,120
West Gulf:												
Softwood	2,636,377	2,036,922	4,985	----	246,690	107,577	44,512	145,166	1,274	46,186	365	2,700
Hardwood	2,198,834	1,076,227	213,199	97,033	45,347	481,533	----	3,776	31,098	200,452	----	50,169
Total	4,835,211	3,113,149	218,184	97,033	292,037	589,110	44,512	148,942	32,372	246,638	365	52,869
Total, South:												
Softwood	11,720,430	8,738,805	42,894	117,225	1,709,402	463,724	98,711	342,862	10,737	151,533	5,893	38,644
Hardwood	7,878,132	4,599,883	955,819	239,287	234,750	1,228,368	1,248	3,776	86,846	322,131	10,054	195,970
Total	19,598,562	13,338,688	998,713	356,512	1,944,152	1,692,092	99,959	346,638	97,583	473,664	15,947	234,614
West:												
Pacific Northwest:												
Douglas-fir subregion:												
Softwood	12,169,523	8,971,166	1,176,240	11,683	1,667,305	88,548	29,335	66,028	5,979	----	880	152,359
Hardwood	51,292	18,660	----	----	28,092	3,903	----	----	230	----	----	407
Total	12,220,815	8,989,826	1,176,240	11,683	1,695,397	92,451	29,335	66,028	6,209	----	880	152,766
Pine subregion:												
Softwood	2,049,718	1,957,740	14,368	----	37,780	16,974	----	8,447	11,704	----	2,324	381
Hardwood	143	----	----		143	----						----
Total	2,049,861	1,957,740	14,368	----	37,923	16,974	----	8,447	11,704	----	2,324	381
Total, Pacific Northwest:												
Softwood	14,219,241	10,928,906	1,190,608	11,683	1,705,085	105,522	29,335	74,475	17,683	----	3,204	152,740
Hardwood	51,435	18,660	----	----	28,235	3,903	----	----	230	----	----	407
Total	14,270,676	10,947,566	1,190,608	11,683	1,733,320	109,425	29,335	74,475	17,913	----	3,204	153,147
California:												
Softwood	5,704,180	5,266,878	331,659	5,722	53,574	3,000	3,702	4,685	18,224	248	1,516	14,972
Hardwood	20,018	15,104	522	4	340	188	11	12	93	1	1	3,742
Total	5,724,198	5,281,982	332,181	5,726	53,914	3,188	3,713	4,697	18,317	249	1,517	18,714

See footnotes at end of table.

TABLE 46.—*Timber cut from live sawtimber on commercial forest land in the United States and Coastal Alaska, by product, section, region of origin, and softwoods and hardwoods, 1952*—Continued

VOLUME IN BOARD-FEET [1]—Continued

Section, region, and species group	Total, all products	Saw logs (for lumber, etc.)	Veneer logs and bolts	Cooperage logs, and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other [2]
West—Continued												
Northern Rocky Mountain:	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*
Softwood	1, 896, 823	1, 770, 653	8, 797		58, 774	6, 852		30, 350	4, 315		16, 444	638
Hardwood	2, 193	201			794	1, 198						
Total	1, 899, 016	1, 770, 854	8, 797		59, 568	8, 050		30, 350	4, 315		16, 444	638
Southern Rocky Mountain:												
Softwood	548, 993	536, 006				1, 673		7, 308	905		2, 224	877
Hardwood	6, 011	696				735						4, 580
Total	555, 004	536, 702				2, 408		7, 308	905		2, 224	5, 457
Total, West:												
Softwood	22, 369, 237	18, 502, 443	1, 531, 064	17, 405	1, 817, 433	117, 047	33, 037	116, 818	41, 127	248	23, 388	169, 227
Hardwood	79, 657	34, 661	522	4	29, 369	6, 024	11	12	323	1	1	8, 729
Total	22, 448, 894	18, 537, 104	1, 531, 586	17, 409	1, 846, 802	123, 071	33, 048	116, 830	41, 450	249	23, 389	177, 956
United States:												
Softwood	36, 459, 770	28, 807, 616	1, 575, 624	143, 276	4, 249, 942	595, 128	146, 488	465, 742	68, 759	151, 781	40, 733	214, 681
Hardwood	12, 293, 967	7, 745, 658	1, 227, 466	373, 026	441, 490	1, 650, 573	11, 475	3, 788	148, 757	331, 240	59, 371	301, 123
Total	48, 753, 737	36, 553, 274	2, 803, 090	516, 302	4, 691, 432	2, 245, 701	157, 963	469, 530	217, 516	483, 021	100, 104	515, 804
Coastal Alaska:												
Softwood	86, 092	82, 924	31		1, 833	83	1, 177	32	12			
Hardwood												
Total	86, 092	82, 924	31		1, 833	83	1, 177	32	12			
All regions:												
Softwood	36, 545, 862	28, 890, 540	1, 575, 655	143, 276	4, 251, 775	595, 211	147, 665	465, 774	68, 771	151, 781	40, 733	214, 681
Hardwood	12, 293, 967	7, 745, 658	1, 227, 466	373, 026	441, 490	1, 650, 573	11, 475	3, 788	148, 757	331, 240	59, 371	301, 123
Total	48, 839, 829	36, 636, 198	2, 803, 121	516, 302	4, 693, 265	2, 245, 784	159, 140	469, 562	217, 528	483, 021	100, 104	515, 804

VOLUME IN CUBIC FEET [3]

Section, region, and species group	Total, all products	Saw logs (for lumber, etc.)	Veneer logs and bolts	Cooperage logs, and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other [2]
North:												
New England:	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
Softwood	306, 677	186, 451		2, 177	116, 807	582	223	174	131			132
Hardwood	79, 065	44, 240	13, 164	68	17, 260	3, 219	83		15			1, 016
Total	385, 742	230, 691	13, 164	2, 245	134, 067	3, 801	306	174	146			1, 148
Middle Atlantic:												
Softwood	107, 816	80, 697	160		22, 496	1, 248	2, 710	79	146		11	269
Hardwood	254, 937	192, 170	8, 208	1, 785	15, 694	16, 027	1, 485		4, 134		9, 892	5, 542
Total	362, 753	272, 867	8, 368	1, 785	38, 190	17, 275	4, 195	79	4, 280		9, 903	5, 811
Lake States:												
Softwood	82, 937	47, 131	73		24, 215	2, 854	230	1, 019	3, 109		3, 175	1, 131
Hardwood	183, 452	109, 975	13, 932	298	8, 377	37, 642	404		2, 354		1, 674	8, 796
Total	266, 389	157, 106	14, 005	298	32, 592	40, 496	634	1, 019	5, 463		4, 849	9, 927
Central:												
Softwood	13, 030	11, 774	57		20	20		49	1, 110			
Hardwood	279, 947	198, 729	11, 298	20, 259	850	37, 327	168		5, 198	1, 645		4, 473
Total	292, 977	210, 503	11, 355	20, 259	870	37, 347	168	49	6, 308	1, 645		4, 473
Plains:												
Softwood	2, 303	1, 890			168	143			102			
Hardwood	16, 073	8, 721	1, 290			4, 621			1, 392			49
Total	18, 376	10, 611	1, 290		168	4, 764			1, 494			49
Total, North:												
Softwood	512, 763	327, 943	290	2, 177	163, 706	4, 847	3, 163	1, 321	4, 598		3, 186	1, 532
Hardwood	813, 474	553, 835	47, 892	22, 410	42, 181	98, 836	2, 140		13, 093	1, 645	11, 566	19, 876
Total	1, 326, 237	881, 778	48, 182	24, 587	205, 887	103, 683	5, 303	1, 321	17, 691	1, 645	14, 752	21, 408
South:												
South Atlantic:												
Softwood	710, 652	514, 214	3, 919	5, 714	123, 196	44, 748	3, 482	7, 017	1, 561	1, 152	574	5, 075
Hardwood	437, 639	299, 399	64, 932	862	18, 101	35, 289	239		1, 713	4, 032	2, 858	10, 214
Total	1, 148, 291	813, 613	68, 851	6, 576	141, 297	80, 037	3, 721	7, 017	3, 274	5, 184	3, 432	15, 289

See footnotes at end of table.

TABLE 46.—*Timber cut from live sawtimber on commercial forest land in the United States and Coastal Alaska, by product, section, region of origin, and softwoods and hardwoods, 1952* —Continued

VOLUME IN CUBIC FEET [3]—Continued

Section, region, and species group	Total, all products	Saw logs (for lumber, etc.)	Veneer logs and bolts	Cooperage logs, and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other [2]
	Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
South—Continued												
Southeast:												
Softwood	1, 152, 356	785, 572	4, 423	16, 471	225, 025	52, 953	7, 747	34, 150	888	21, 999	645	2, 483
Hardwood	776, 607	421, 291	86, 629	29, 494	27, 691	157, 005	27	----	8, 865	23, 757	----	21, 848
Total	1, 928, 963	1, 206, 863	91, 052	45, 965	252, 716	209, 958	7, 774	34, 150	9, 753	45, 756	645	24, 331
West Gulf:												
Softwood	501, 938	372, 253	902	----	60, 128	21, 319	8, 807	28, 724	594	8, 505	63	643
Hardwood	461, 381	224, 712	38, 455	22, 571	10, 656	101, 791	----	590	5, 538	45, 053	----	12, 015
Total	963, 319	596, 965	39, 357	22, 571	70, 784	123, 110	8, 807	29, 314	6, 132	53, 558	63	12, 658
Total, South:												
Softwood	2, 364, 946	1, 672, 039	9, 244	22, 185	408, 349	119, 020	20, 036	69, 891	3, 043	31, 656	1, 282	8, 201
Hardwood	1, 675, 627	945, 402	190, 016	52, 927	56, 448	294, 085	266	590	16, 116	72, 842	2, 858	44, 077
Total	4, 040, 573	2, 617, 441	199, 260	75, 112	464, 797	413, 105	20, 302	70, 481	19, 159	104, 498	4, 140	52, 278
West:												
Pacific Northwest:												
Douglas-fir subregion:												
Softwood	2, 009, 266	1, 488, 895	188, 958	1, 842	272, 800	14, 945	4, 676	10, 515	997	----	147	25, 491
Hardwood	8, 571	3, 176	----	----	4, 640	652	----	----	37	----	----	66
Total	2, 017, 837	1, 492, 071	188, 958	1, 842	277, 440	15, 597	4, 676	10, 515	1, 034	----	147	25, 557
Pine subregion:												
Softwood	356, 049	340, 637	2, 398	----	6, 193	2, 954	----	1, 381	2, 037	----	383	66
Hardwood	22	----	----	----	22	----	----	----	----	----	----	----
Total	356, 071	340, 637	2, 398	----	6, 215	2, 954	----	1, 381	2, 037	----	383	66
Total, Pacific Northwest:												
Softwood	2, 365, 315	1, 829, 532	191, 356	1, 842	278, 993	17, 899	4, 676	11, 896	3, 034	----	530	25, 557
Hardwood	8, 593	3, 176	----	----	4, 662	652	----	----	37	----	----	66
Total	2, 373, 908	1, 832, 708	191, 356	1, 842	283, 655	18, 551	4, 676	11, 896	3, 071	----	530	25, 623
California:												
Softwood	915, 314	848, 585	47, 765	825	9, 915	540	809	1, 109	3, 094	28	340	2, 304
Hardwood	8, 567	6, 944	201	1	195	30	7	8	46	(4)	1	1, 134
Total	923, 881	855, 529	47, 966	826	10, 110	570	816	1, 117	3, 140	28	341	3, 438
Northern Rocky Mountain:												
Softwood	301, 531	279, 552	1, 466	----	10, 051	1, 257	----	5, 544	737	----	2, 831	93
Hardwood	384	33	----	----	127	224	----	----	----	----	----	----
Total	301, 915	279, 585	1, 466	----	10, 178	1, 481	----	5, 544	737	----	2, 831	93
Southern Rocky Mountain:												
Softwood	88, 647	86, 355	----	----	----	310	----	1, 293	159	----	381	149
Hardwood	1, 090	119	----	----	----	138	----	----	----	----	----	833
Total	89, 737	86, 474	----	----	----	448	----	1, 293	159	----	381	982
Total, West:												
Softwood	3, 670, 807	3, 044, 024	240, 587	2, 667	298, 959	20, 006	5, 485	19, 842	7, 024	28	4, 082	28, 103
Hardwood	18, 634	10, 272	201	1	4, 984	1, 044	7	8	83	(4)	1	2, 033
Total	3, 689, 441	3, 054, 296	240, 788	2, 668	303, 943	21, 050	5, 492	19, 850	7, 107	28	4, 083	30, 136
United States:												
Softwood	6, 548, 516	5, 044, 006	250, 121	27, 029	871, 014	143, 873	28, 684	91, 054	14, 665	31, 684	8, 550	37, 836
Hardwood	2, 507, 735	1, 509, 509	238, 109	75, 338	103, 613	393, 965	2, 413	598	29, 292	74, 487	14, 425	65, 986
Total	9, 056, 251	6, 553, 515	488, 230	102, 367	974, 627	537, 838	31, 097	91, 652	43, 957	106, 171	22, 975	103, 822
Coastal Alaska:												
Softwood	12, 156	11, 690	4	----	263	15	177	5	2	----	----	----
Hardwood	----	----	----	----	----	----	----	----	----	----	----	----
Total	12, 156	11, 690	4	----	263	15	177	5	2	----	----	----
All regions:												
Softwood	6, 560, 672	5, 055, 696	250, 125	27, 029	871, 277	143, 888	28, 861	91, 059	14, 667	31, 684	8, 550	37, 836
Hardwood	2, 507, 735	1, 509, 509	238, 109	75, 338	103, 613	393, 965	2, 413	598	29, 292	74, 487	14, 425	65, 986
Total	9, 068, 407	6, 565, 205	488, 234	102, 367	974, 890	537, 853	31, 274	91, 657	43, 959	106, 171	22, 975	103, 822

[1] Volumes are board-feet log scale, International ¼-inch rule; they represent the net board-foot volume of the saw-log part of live sawtimber trees (from stump to merchantable top) cut or killed in logging and converted to timber products or left as logging residues.

[2] Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and other such products.

[3] Volumes are in cubic feet roundwood excluding bark; they represent the net cubic-foot volume of live sawtimber trees from stump to minimum 4.0-inch top (of central stem) inside bark cut or killed in logging and converted to timber products or left as logging residues.

[4] Less than 0.5 thousand cubic feet.

TABLE 47.—*Timber cut for all products from live sawtimber on commercial forest land in Eastern United States, by species group and section and region of origin, 1952* [1]

VOLUME IN BOARD-FEET

Species group	Total, East	North: Total	North: New England	North: Middle Atlantic	North: Lake States	North: Central	North: Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
	Thousand bd.-ft.	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*
Softwoods:											
White, red, and jack pine	971,401	929,171	617,873	148,535	162,032	731	---	42,230	29,195	13,035	---
Southern yellow pine	11,609,957	257,184	8,006	178,001	---	60,953	10,224	11,352,773	3,228,160	5,545,510	2,579,103
Spruce-fir	668,476	668,226	560,644	63,791	43,791	---	---	250	250	---	---
Other softwoods	840,699	515,522	194,395	117,204	178,136	23,772	2,015	325,177	102,328	165,575	57,274
Total, softwoods	14,090,533	2,370,103	1,380,918	507,531	383,959	85,456	12,239	11,720,430	3,359,933	5,724,120	2,636,377
Hardwoods:											
Yellow-poplar	987,425	174,263	867	76,431	---	96,965	---	813,162	399,226	409,361	4,575
Other soft hardwoods	3,892,777	876,194	86,204	217,122	259,587	283,040	30,241	3,016,583	662,279	1,503,640	850,664
Total	4,880,202	1,050,457	87,071	293,553	259,587	380,005	30,241	3,829,745	1,061,505	1,913,001	855,239
Oak	4,894,225	1,614,427	41,168	486,451	157,274	898,840	30,694	3,279,798	803,789	1,405,138	1,070,871
Beech-yellow birch-hard maple	1,289,748	1,178,061	244,967	408,726	332,886	191,468	14	111,687	23,051	71,005	17,631
Other hard hardwoods	1,150,135	493,233	14,332	98,655	106,701	253,201	20,344	656,902	103,887	297,922	255,093
Total	7,334,108	3,285,721	300,467	993,832	596,861	1,343,509	51,052	4,048,387	930,727	1,774,065	1,343,595
Total, hardwoods	12,214,310	4,336,178	387,538	1,287,385	856,448	1,723,514	81,293	7,878,132	1,992,232	3,687,066	2,198,834
All species	26,304,843	6,706,281	1,768,456	1,794,916	1,240,407	1,808,970	93,532	19,598,562	5,352,165	9,411,186	4,835,211

VOLUME IN CUBIC FEET

Species group	Total, East	North: Total	North: New England	North: Middle Atlantic	North: Lake States	North: Central	North: Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
	Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
Softwoods:											
White, red, and jack pine	212,717	204,461	140,840	29,975	33,535	111	---	8,256	5,820	2,436	---
Southern yellow pine	2,346,277	53,792	1,740	40,736	---	9,405	1,911	2,292,485	684,123	1,117,112	491,250
Spruce-fir	145,799	145,749	120,099	13,426	12,224	---	---	50	50	---	---
Other softwoods	172,916	108,761	43,998	23,679	37,178	3,514	392	64,155	20,659	32,808	10,688
Total, softwoods	2,877,709	512,763	306,677	107,816	82,937	13,030	2,303	2,364,946	710,652	1,152,356	501,938
Hardwoods:											
Yellow-poplar	198,042	29,991	177	14,508	---	15,306	---	168,051	82,820	84,289	942
Other soft hardwoods	804,157	169,563	16,944	42,045	58,490	46,444	5,640	634,594	145,098	313,914	175,582
Total	1,002,199	199,554	17,121	56,553	58,490	61,750	5,640	802,645	227,918	398,203	176,524
Oak	1,004,552	294,336	8,418	98,351	35,444	145,815	6,308	710,216	182,677	300,328	227,211
Beech-yellow birch-hard maple	251,659	228,517	50,629	80,139	67,492	30,252	5	23,142	4,641	14,842	3,659
Other hard hardwoods	230,556	90,932	2,897	19,894	22,026	42,130	3,985	139,624	22,403	63,234	53,987
Total	1,486,767	613,785	61,944	198,384	124,962	218,197	10,298	872,982	209,721	378,404	284,857
Total, hardwoods	2,488,966	813,339	79,065	254,937	183,452	279,947	15,938	1,675,627	437,639	776,607	461,381
All species	5,366,675	1,326,102	385,742	362,753	266,389	292,977	18,241	4,040,573	1,148,291	1,928,963	963,319

[1] Volumes refer to live sawtimber inventory and are in board-feet log scale, International 1/4-inch rule, and in cubic feet roundwood excluding bark, they represent the net board-foot volume of the saw-log part of live sawtimber trees (from stump to merchantable top) and the net cubic-foot volume of live sawtimber trees from stump to minimum 4.0-inch top (of central stem) inside bark cut or killed in logging and converted to timber products or left as logging residues.

TABLE 48.—*Timber cut for all products from live sawtimber on commercial forest land in Western United States and Coastal Alaska, by species group and section and region of origin, 1952* [1]

VOLUME IN BOARD-FEET

Species group	Total, West and Coastal Alaska	West							Coastal Alaska
		Total	Pacific Northwest			California	Northern Rocky Mountain	Southern Rocky Mountain	
			Total	Douglas-fir subregion	Pine sub-region				
	Thousand bd.-ft.	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*	*Thousand bd.-ft.*
Softwoods:									
Douglas-fir	11, 961, 923	11, 961, 923	9, 192, 326	8, 826, 808	365, 518	2, 333, 575	392, 829	43, 193	
Ponderosa and Jeffrey pine	3, 603, 266	3, 603, 266	1, 497, 450	149, 552	1, 347, 898	1, 274, 048	474, 256	357, 512	
Western hemlock	2, 225, 575	2, 205, 029	2, 192, 990	2, 172, 194	20, 796	2, 069	9, 970		20, 546
White and sugar pine	608, 728	608, 728	63, 202	22, 663	40, 539	323, 862	221, 664		
Redwood	986, 864	986, 864				986, 864			
Other softwoods	3, 068, 973	3, 003, 427	1, 273, 273	998, 306	274, 967	783, 762	798, 104	148, 288	65, 546
Total	22, 455, 329	22, 369, 237	14, 219, 241	12, 169, 523	2, 049, 718	5. 704, 180	1, 896, 823	548, 993	86, 092
Hardwoods	79, 657	79, 657	51, 435	51, 292	143	20, 018	2, 193	6, 011	
Total, all species	22, 534, 986	22, 448, 894	14, 270, 676	12, 220, 815	2, 049, 861	5, 724, 198	1, 899, 016	555, 004	86, 092

VOLUME IN CUBIC FEET

Species group	Total, West and Coastal Alaska	West Total	Pacific Northwest Total	Douglas-fir subregion	Pine sub-region	California	Northern Rocky Mountain	Southern Rocky Mountain	Coastal Alaska
	Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
Softwoods:									
Douglas-fir	1, 952, 704	1, 952. 704	1, 513, 554	1, 450, 029	63, 525	369, 772	62, 454	6, 924	
Ponderosa and Jeffrey pine	597, 234	597, 234	258, 769	24, 345	234, 424	204, 598	76, 986	56, 881	
Western hemlock	372, 503	369, 591	367, 664	364, 183	3, 481	314	1, 613		2, 912
White and sugar pine	96, 272	96, 272	10, 836	3, 780	7, 056	50, 759	34, 677		
Redwood	163, 189	163, 189				163, 189			
Other softwoods	501, 061	491, 817	214, 492	166, 929	47, 563	126, 682	125, 801	24, 842	9, 244
Total	3, 682, 963	3, 670, 807	2, 365, 315	2, 009, 266	356, 049	915, 314	301, 531	88, 647	12, 156
Hardwoods	18, 634	18, 634	8, 593	8, 571	22	8, 567	384	1, 090	
Total, all species	3, 701, 597	3, 689, 441	2, 373, 908	2, 017, 837	356, 071	923, 881	301, 915	89, 737	12, 156

[1] Volumes refer to live sawtimber inventory and are in board-feet log scale, International ¼-inch rule, and in cubic feet roundwood excluding bark; they represent the net board-foot volume of the saw-log part of live sawtimber trees (from stump to merchantable top) and the net cubic-foot volume of live sawtimber trees from stump to minimum 4.0-inch top (of central stem) inside bark cut or killed in logging and converted to timber products or left as logging residues.

TABLE 49.—*Timber cut from growing stock on commercial forest land in the United States and Coastal Alaska, by product, section and region of origin, and softwoods and hardwoods, 1952* [1]

Section, region, and species group	Total, all products	Saw logs (for lumber, etc.)	Veneer logs and bolts	Cooperage logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other [2]
	Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
North:												
New England:												
Softwood	361, 082	199, 400		3, 624	153, 380	2, 245	223	184	1, 875			151
Hardwood	139, 136	58, 046	13, 740	110	36, 038	29, 412	83		587			1, 120
Total	500. 218	257, 446	13, 740	3, 734	189, 418	31, 657	306	184	2, 462			1, 271
Middle Atlantic:												
Softwood	129, 504	86, 331	160		36, 156	2, 162	2, 710	82	1, 151		53	699
Hardwood	339, 795	208. 625	8, 369	1, 785	36. 213	35, 242	1, 485		11, 566		28, 747	7, 763
Total	469. 299	294, 956	8, 529	1, 785	72, 369	37, 404	4. 195	82	12, 717		28, 800	8, 462
Lake States:												
Softwood	188, 566	55, 621	73		108, 846	6, 670	230	1, 831	8, 839		4, 662	1, 794
Hardwood	348, 604	139, 061	13, 932	298	70, 035	97, 792	404		7, 517		2, 072	17, 493
Total	537, 170	194, 682	14, 005	298	178, 881	104, 462	634	1, 831	16. 356		6, 734	19, 287
Central:												
Softwood	16, 911	12, 084	57		322	55		64	4, 188			141
Hardwood	388, 231	202, 327	11, 338	20. 290	7, 482	102, 800	169		16, 717	1, 645	18, 155	7, 308
Total	405, 142	214, 411	11, 395	20, 290	7, 804	102, 855	169	64	20. 905	1, 645	18, 155	7, 449
Plains:												
Softwood	3, 960	1, 975			497	148		18	1, 322			
Hardwood	24, 144	8, 937	1, 294			9, 983			3, 823			107
Total	28, 104	10, 912	1, 294		497	10. 131		18	5, 145			107
Total, North:												
Softwood	700, 023	355. 411	290	3, 624	299, 201	11, 280	3, 163	2, 179	17, 375		4, 715	2, 785
Hardwood	1, 239, 910	616, 996	48, 673	22, 483	149, 768	275. 229	2, 141		40, 210	1, 645	48, 974	33, 791
Total	1. 939, 933	972. 407	48, 963	26, 107	448, 969	286. 509	5, 304	2, 179	57, 585	1, 645	53, 689	36, 576

See footnotes at end of table.

TABLE 49.—*Timber cut from growing stock on commercial forest land in the United States and Coastal Alaska, by product, section and region of origin, and softwoods and hardwoods, 1952* [1]—Continued

Section, region, and species group	Total, all products	Saw logs (for lumber, etc.)	Veneer logs and bolts	Cooperage logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other [2]
	Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
South:												
South Atlantic:												
Softwood	915,856	553,885	3,902	5,714	207,520	112,711	3,795	7,378	6,535	1,158	1,044	12,214
Hardwood	539,092	309,477	65,668	862	38,100	90,800	260	------	7,168	4,047	6,086	16,624
Total	1,454,948	863.362	69,570	6,576	245,620	203,511	4,055	7,378	13,703	5,205	7,130	28,838
Southeast:												
Softwood	1,479,153	835,391	4,494	16,937	464,547	73,976	8,098	35,600	7,302	22,098	3,067	7,643
Hardwood	926,306	435,449	87,662	29,692	53,917	241,966	27	------	21,584	24,488	2,610	28,911
Total	2,405,459	1,270,840	92,156	46,629	518,464	315,942	8,125	35,600	28,886	46,586	5,677	36,554
West Gulf:												
Softwood	651,101	390,018	948	------	177,851	22,967	9,139	29,807	9,110	8,505	304	2,452
Hardwood	541,745	232,261	38,949	22,736	20,527	150,645	------	590	12,645	46,567	506	16,319
Total	1,192,846	622,279	39,897	22,736	198,378	173,612	9,139	30,397	21,755	55,072	810	18,771
Total, South:												
Softwood	3,046,110	1,779,294	9,344	22,651	849,918	209,654	21,032	72,785	22,947	31,761	4,415	22,309
Hardwood	2,007,143	977,187	192,279	53,290	112,544	483,411	287	590	41,397	75,102	9,202	61,854
Total	5,053,253	2,756,481	201,623	75,941	962,462	693,065	21,319	73,375	64,344	106,863	13,617	84,163
West:												
Pacific Northwest:												
Douglas-fir subregion:												
Softwood	2,022,525	1,492,797	188,958	1,842	277,236	15,799	4,676	11,133	1,033	------	172	28,879
Hardwood	8,750	3,176	------	------	4,715	753	------	------	40	------	------	66
Total	2,031,275	1,495,973	188,958	1,842	281,951	16,552	4,676	11,133	1,073	------	172	28,945
Pine subregion:												
Softwood	359,249	340,995	2,398	------	6,798	3,522	------	2,442	2,436	------	473	185
Hardwood	22	------	------	------	22	------	------	------	------	------	------	------
Total	359,271	340,995	2,398	------	6,820	3,522	------	2,442	2,436	------	473	185
Total, Pacific Northwest:												
Softwood	2,381,774	1,833,792	191,356	1,842	284,034	19,321	4,676	13,575	3,469	------	645	29,064
Hardwood	8,772	3,176	------	------	4,737	753	------	------	40	------	------	66
Total	2,390,546	1,836,968	191,356	1,842	288,771	20,074	4,676	13,575	3,509	------	645	29,130
California:												
Softwood	920,389	853,295	47,926	827	9,936	540	819	1,144	3,108	28	445	2,321
Hardwood	11,147	9,316	268	1	263	60	9	10	62	(3)	3	1,155
Total	931,536	862,611	48,194	828	10,199	600	828	1,154	3,170	28	448	3,476
Northern Rocky Mountain:												
Softwood	327,836	286,606	1,508	------	16,701	2,226	10	9,245	2,267	------	6,915	2,358
Hardwood	1,257	33	------	------	129	1,095	------	------	------	------	------	------
Total	329,093	286,639	1,508	------	16,830	3,321	10	9,245	2,267	------	6,915	2,358
Southern Rocky Mountain:												
Softwood	98,587	93,338	------	------	------	500	5	1,867	411	------	1,769	697
Hardwood	1,453	122	------	------	------	190	------	------	------	------	------	1,141
Total	100,040	93,460	------	------	------	690	5	1,867	411	------	1,769	1,838
Total, West:												
Softwood	3,728,586	3,067,031	240,790	2,669	310,671	22,587	5,510	25,831	9,255	28	9,774	34,440
Hardwood	22,629	12,647	268	1	5,129	2,098	9	10	102	(3)	3	2,362
Total	3,751,215	3,079,678	241,058	2,670	315,800	24,685	5,519	25,841	9,357	28	9,777	36,802
United States:												
Softwood	7,474,719	5,201,736	250,424	28,944	1,459,790	243,521	29,705	100,795	49,577	31,789	18,904	59,534
Hardwood	3,269,682	1,606,830	241,220	75,774	267,441	760,738	2,437	600	81,709	76,747	58,179	98,007
Total	10,744,401	6,808,566	491,644	104,718	1,727,231	1,004,259	32,142	101,395	131,286	108,536	77,083	157,541
Coastal Alaska:												
Softwood	12,372	11,887	4	------	267	20	180	10	4	------	------	------
Hardwood	------	------	------	------	------	------	------	------	------	------	------	------
Total	12,372	11,887	4	------	267	20	180	10	4	------	------	------
All regions:												
Softwood	7,487,091	5,213,623	250,428	28,944	1,460,057	243,541	29,885	100,805	49,581	31,789	18,904	59,534
Hardwood	3,269,682	1,606,830	241,220	75,774	267,441	760,738	2,437	600	81,709	76,747	58,179	98,007
Total	10,756,773	6,820,453	491,648	104,718	1,727,498	1,004,279	32,322	101,405	131,290	108,536	77,083	157,541

[1] Timber cut includes logging residues as well as growing stock inventory removed as timber products. Volumes are in cubic feet roundwood excluding bark.

[2] Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, and other such products.

[3] Less than 0.5 thousand cubic feet.

TABLE 50.—*Timber cut from growing stock on commercial forest land in Eastern United States, by product, section and region of origin, and softwoods and hardwoods, 1952* [1]

Section, region, and species group	Total, all products	Saw logs (for lumber, etc.)	Veneer logs and bolts	Cooperage logs and bolts	Pulpwood	Fuelwood	Piling	Poles	Posts (round and split)	Hewn ties	Mine timbers (round)	Other [2]
	Thousand cords	*Thousand cords*	*Thousand cords*	*Thousand cords*	*Thousand cords*	*Thousand cords*	*Thousand cords*	*Thousand cords*	*Thousand cords*	*Thousand cords*	*Thousand cords*	*Thousand cords*
North:												
New England:												
Softwood	4, 512	2, 492		45	1, 917	28	3	2	24			1
Hardwood	1, 735	726	171	2	449	368	(3)		6			13
Total	6, 247	3, 218	171	47	2, 366	396	3	2	30			14
Middle Atlantic:												
Softwood	1, 621	1, 079	2		454	27	35	2	13		(3)	9
Hardwood	4, 249	2, 609	105	23	453	440	18		145		359	97
Total	5, 870	3, 688	107	23	907	467	53	2	158		359	106
Lake States:												
Softwood	2, 357	695	(3)		1, 361	89	3	23	110		56	20
Hardwood	4, 354	1, 737	175	4	875	1, 223	5		91		26	218
Total	6, 711	2, 432	175	4	2, 236	1, 312	8	23	201		82	238
Central:												
Softwood	243	165	1		5	1		1	68			2
Hardwood	5, 343	2, 516	142	256	121	1, 620	1		266	21	293	107
Total	5, 586	2, 681	143	256	126	1, 621	1	1	334	21	293	109
Plains:												
Softwood	52	26			7	2		(3)	17			
Hardwood	336	122	17			142			53			2
Total	388	148	17		7	144		(3)	70			2
Total, North:												
Softwood	8, 785	4, 457	3	45	3, 744	147	41	28	232		56	32
Hardwood	16, 017	7, 710	610	285	1, 898	3, 793	24		561	21	678	437
Total	24, 802	12, 167	613	330	5, 642	3, 940	65	28	793	21	734	469
South:												
South Atlantic:												
Softwood	12, 128	7, 044	49	74	2, 968	1, 595	46	90	90	13	13	146
Hardwood	6, 903	3, 822	798	10	484	1, 357	4		100	48	80	200
Total	19, 031	10, 866	847	84	3, 452	2, 952	50	90	190	61	93	346
Southeast:												
Softwood	19, 670	10, 860	59	223	6, 452	1, 012	105	459	100	262	41	97
Hardwood	12, 797	6, 210	1, 170	442	690	3, 154	1		318	358	39	415
Total	32, 467	17, 070	1, 229	665	7, 142	4, 166	106	459	418	620	80	512
West Gulf:												
Softwood	8, 681	5, 200	11		2, 371	306	123	398	121	114	4	33
Hardwood	7, 727	3, 466	583	339	264	1, 931		9	189	695	7	244
Total	16, 408	8, 666	594	339	2, 635	2, 237	123	407	310	809	11	277
Total, South:												
Softwood	40, 479	23, 104	119	297	11, 791	2, 913	274	947	311	389	58	276
Hardwood	27, 427	13, 498	2, 551	791	1, 438	6, 442	5	9	607	1, 101	126	859
Total	67, 906	36, 602	2, 670	1, 088	13, 229	9, 355	279	956	918	1, 490	184	1, 135

[1] Estimates of timber cut refer to growing stock inventory and include logging residues as well as growing stock material removed as timber products. Volumes are in standard cords (128 cu. ft.) including bark.

[2] Includes box and shingle bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood and other such products.

[3] Less than 0.5 thousand cords.

TABLE 51.—*Timber cut for all products from growing stock on commercial forest land in Eastern United States, by species group and section and region of origin, 1952* [1]

VOLUME IN CUBIC FEET

Species group	Total, East	North						South			
		Total	New England	Middle Atlantic	Lake States	Central	Plains	Total	South Atlantic	Southeast	West Gulf
	Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
Softwoods:											
White, red, and jack pine	256, 760	247, 828	152, 790	30, 703	64, 222	113		8, 932	6, 341	2, 591	
Southern yellow pine	3, 028, 932	68, 290	2, 231	53, 693		10, 043	2, 323	2, 960, 642	883, 717	1, 438, 227	638, 698
Spruce-fir	242, 855	242, 801	156, 643	17, 553	68, 605			54	54		
Other softwoods	217, 567	141, 085	49, 418	27, 555	55, 739	6, 755	1, 618	76, 482	25, 744	38, 335	12, 403
Total, softwoods	3, 746, 114	700, 004	361, 082	129, 504	188, 566	16, 911	3, 941	3, 046, 110	915, 856	1, 479, 153	651, 101

See footnote at end of table.

TABLE 51.—*Timber cut for all products from growing stock on commercial forest land in Eastern United States, by species group and section and region of origin, 1952* [1]—Continued

VOLUME IN CUBIC FEET—Continued

Species group	Total, East	North: Total	North: New England	North: Middle Atlantic	North: Lake States	North: Central	North: Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
	Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
Hardwoods:											
Yellow-poplar	216, 683	35, 147	212	18, 551		16, 384		181, 536	90, 870	89, 644	1, 022
Other soft hardwoods	1, 055, 556	322, 090	37, 964	55, 499	168, 313	53, 297	7, 017	733, 466	175, 882	360, 193	197, 391
Total	1, 272, 239	357, 237	38, 176	74, 050	168, 313	69, 681	7, 017	915, 002	266, 752	449, 837	198, 413
Oak	1, 292, 415	407, 373	17, 278	132, 130	59, 041	189, 510	9, 414	885, 042	236, 853	376, 516	271, 673
Beech-yellow birch-hard maple	324, 787	299, 501	79, 610	97, 301	90, 485	32, 092	13	25, 286	4, 797	16, 546	3, 943
Other hard hardwoods	357, 477	175, 664	4, 072	36, 314	30, 765	96, 948	7, 565	181, 813	30, 690	83, 407	67, 716
Total	1, 974, 679	882, 538	100, 960	265, 745	180, 291	318, 550	16, 992	1, 092, 141	272, 340	476, 469	343, 332
Total, hardwoods	3, 246, 918	1, 239, 775	139, 136	339, 795	348, 604	388, 231	24, 009	2, 007, 143	539, 092	926, 306	541, 745
All species	6, 993, 032	1, 939, 779	500, 218	469, 299	537, 170	405, 142	27, 950	5, 053, 253	1, 454, 948	2, 405, 459	1, 192, 846

VOLUME IN CORDS

Species group	Total, East	North: Total	North: New England	North: Middle Atlantic	North: Lake States	North: Central	North: Plains	South: Total	South: South Atlantic	South: Southeast	South: West Gulf
	Thousand cords	*Thousand cords*	*Thousand cords*	*Thousand cords*	*Thousand cords*	*Thousand cords*	*Thousand cords*	*Thousand cords*	*Thousand cords*	*Thousand cords*	*Thousand cords*
Softwoods:											
White, red, and jack pine	3, 212	3, 098	1, 910	383	803	1		114	80	34	
Southern yellow pine	40, 242	873	28	674		139	32	39, 369	11, 715	19, 140	8, 514
Spruce-fir	3, 034	3, 033	1, 958	219	856			1	1		
Other softwoods	2, 776	1, 781	616	345	698	103	20	995	332	496	167
Total, softwoods	49, 264	8, 785	4, 512	1, 621	2, 357	243	52	40, 479	12, 128	19, 670	8, 681
Hardwoods:											
Yellow-poplar	2, 820	443	2	233		208		2, 377	1, 127	1, 235	15
Other soft hardwoods	14, 104	4, 062	474	693	2, 104	696	95	10, 042	2, 235	4, 947	2, 860
Total	16, 924	4, 505	476	926	2, 104	904	95	12, 419	3, 362	6, 182	2, 875
Oak	17, 438	5, 300	216	1, 653	738	2, 562	131	12, 138	3, 092	5, 212	3, 834
Beech-yellow birch-hard maple	4, 106	3, 750	995	1, 216	1, 130	409		356	60	239	57
Other hard hardwoods	4, 975	2, 461	48	454	382	1, 468	109	2, 514	389	1, 164	961
Total	26, 519	11, 511	1, 259	3, 323	2, 250	4, 439	240	15, 008	3, 541	6, 615	4, 852
Total, hardwoods	43. 443	16, 016	1, 735	4, 249	4, 354	5, 343	335	27, 427	6, 903	12, 797	7, 727
All species	92, 707	24, 801	6, 247	5, 870	6, 711	5, 586	387	67, 906	19, 031	32, 467	16, 408

[1] Estimates of timber cut refer to growing stock inventory and include logging residues as well as growing stock material removed as timber products. Volumes are in cubic feet roundwood excluding bark and in standard cords (128 cu. ft.) including bark.

TABLE 52.—*Timber cut for all products from growing stock on commercial forest land in Western United States and Coastal Alaska, by species group and section and region of origin, 1952* [1]

Species group	Total, West and Coastal Alaska	West: Total, West	West: Pacific Northwest: Total	West: Pacific Northwest: Douglas-fir subregion	West: Pacific Northwest: Pine subregion	West: California	West: Northern Rocky Mountain	West: Southern Rocky Mountain	Coastal Alaska
	Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
Softwoods:									
Douglas-fir	1, 965, 780	1, 965, 780	1, 520, 252	1, 456, 575	63, 677	371, 263	66, 480	7, 785	
Ponderosa and Jeffrey pine	605, 461	605, 461	258, 968	24, 440	234, 528	205, 897	80, 740	59, 856	
Western hemlock	376, 511	373, 426	371, 465	367, 943	3, 522	327	1, 634		3, 085
White and sugar pine	96, 894	96, 894	10, 859	3, 792	7, 067	50, 899	35, 136		
Redwood	163, 463	163, 463				163, 463			
Other softwoods	532, 849	523, 562	220, 230	169, 775	50, 455	128, 540	143, 846	30, 946	9, 287
Total	3, 740, 958	3, 728, 586	2, 381, 774	2, 022, 525	359, 249	920, 389	327, 836	98, 587	12, 372
Hardwoods	22, 629	22, 629	8, 772	8, 750	22	11, 147	1, 257	1, 453	
All species	3, 763, 587	3, 751, 215	2, 390, 546	2, 031, 275	359, 271	931, 536	329, 093	100, 040	12, 372

[1] Estimates of timber cut refer to growing stock inventory and include logging residues as well as growing stock material removed as timber products. Volumes are in cubic feet roundwood excluding bark.

TABLE 53.—*Total volume of plant residues produced in the United States and Coastal Alaska*

Section and region	All industries			Lumber		
	Total	Coarse	Fine	Total	Coarse	Fine
	Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
North:						
New England	125, 571	67, 508	58, 063	96, 971	50, 923	46, 048
Middle Atlantic	143, 143	79, 530	63, 613	115, 369	63, 702	51, 667
Lake States	109, 794	60, 780	49, 014	74, 309	40, 809	33, 500
Central	88, 276	53, 921	34, 355	66, 349	40, 739	25, 610
Plains	4, 005	2, 015	1, 990	3, 554	1, 812	1, 742
Total	470, 789	263, 754	207, 035	356, 552	197, 985	158, 567
South:						
South Atlantic	503, 931	241, 393	262, 538	448, 278	210, 781	237, 497
Southeast	662, 349	298, 262	364, 087	570, 379	255, 757	314, 622
West Gulf	308, 277	124, 126	184, 151	267, 043	108, 140	158, 903
Total	1, 474, 557	663, 781	810, 776	1, 285, 700	574. 678	711, 022
West:						
Pacific Northwest:						
Douglas-fir subregion	841, 667	377, 704	463, 963	696, 563	349, 465	347, 098
Pine subregion	130, 476	58, 202	72, 274	128, 653	57, 878	70, 775
Total	972, 143	435, 906	536, 237	825, 216	407, 343	417, 873
California	371, 599	242, 269	129, 330	357, 766	230. 888	126, 878
Northern Rocky Mountain	81, 315	30, 959	50, 356	80, 662	30, 612	50, 050
Southern Rocky Mountain	38, 139	20, 967	17, 172	38, 098	20, 939	17, 159
Total	1, 463, 196	730, 101	733, 095	1, 301, 742	689, 782	611, 960
United States	3, 408, 542	1, 657, 636	1, 750, 906	2, 943, 994	1, 462, 445	1, 481, 549
Coastal Alaska	5, 832	3, 248	2, 584	5, 832	3, 248	2, 584
All regions	3, 414, 374	1, 660, 884	1, 753, 490	2, 949, 826	1, 465, 693	1, 484, 133

[1] Plant residues include only the material left over from converting logs, bolts, and other round timbers to the primary product such as lumber, veneer, pulp, etc., and residues from planing mills integrated with sawmills whether or not the material is subsequently burned as fuel, chipped for pulp or used for various other purposes. Coarse residues include slabs, edgings, trimmings, miscuts, veneer cores, cull pieces, and other material generally

TABLE 54.—*Volume of plant residues from primary manufacturing used in the United*

Section, region, and kind of material	Relation of used residues to total residues	All industries				Lumber			
		Total	Fuel [3]	Fiber [4]	Other [5]	Total	Fuel [3]	Fiber [4]	Other [5]
	Percent	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
North:									
New England:									
Coarse	63	42, 549	40, 454	441	1, 654	26, 035	24, 366	19	1, 650
Fine	69	39, 897	17. 655	10	22, 232	28, 166	6, 253		21, 913
Total	66	82, 446	58, 109	451	23, 886	54. 201	30, 619	19	23, 563
Middle Atlantic:									
Coarse	68	54, 382	48, 548	266	5, 568	38, 741	33, 860		4, 881
Fine	58	37, 246	19, 336		17, 910	25, 646	8, 417		17, 229
Total	64	91, 628	67, 884	266	23. 478	64, 387	42, 277		22, 110
Lake States:									
Coarse	92	56, 259	48, 885	874	6, 500	36. 454	30, 260	804	5, 390
Fine	65	31, 882	25, 070		6, 812	16, 765	10, 084		6, 681
Total	80	88, 141	73, 955	874	13, 312	53, 219	40, 344	804	12, 071
Central:									
Coarse	76	40, 739	35, 265	465	5, 009	30, 769	26, 138		4, 631
Fine	67	22, 998	14, 525		8, 473	16, 605	10, 015		6, 590
Total	72	63, 737	49, 790	465	13, 482	47, 374	36, 153		11, 221
Plains:									
Coarse	71	1, 437	1, 338		99	1, 249	1. 180		69
Fine	35	694	571		123	484	362		122
Total	53	2, 131	1, 909		222	1, 733	1, 542		191
Total, North:									
Coarse	74	195, 366	174, 490	2, 046	18, 830	133, 248	115. 804	823	16, 621
Fine	64	132. 717	77, 157	10	55. 550	87. 666	35, 131		52, 535
Total	70	328, 083	251, 647	2, 056	74. 380	220, 914	150. 935	823	69, 156

See footnotes at end of table.

from primary manufacturing, by industry, kind of material, and section and region, 1952 [1]

Veneer			Cooperage			Pulp			Other [2]		
Total	Coarse	Fine	Total	Coarse	Fine	Total	Coarse	Fine	Total	Coarse	Fine
Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
5, 023	2, 033	2, 990	1, 143	763	380	21, 850	13, 490	8, 360	584	299	285
3, 030	1, 290	1, 740	670	500	170	21, 100	12, 260	8, 840	2, 974	1, 778	1, 196
4, 910	1, 907	3. 003	252	94	158	25, 710	15, 030	10, 680	4, 613	2, 940	1, 673
4, 027	2, 023	2, 004	12, 468	9, 168	3, 300	2, 788	1, 533	1, 255	2, 644	458	2, 186
433	196	237							18	7	11
17, 423	7, 449	9, 974	14, 533	10, 525	4, 008	71, 448	42, 313	29, 135	10, 833	5, 482	5, 351
25, 413	16, 998	8, 415	2, 783	785	1, 998	21, 460	9, 340	12, 120	5, 997	3, 489	2, 508
33, 851	16, 952	16, 899	16, 402	8, 567	7, 835	34, 700	13, 800	20, 900	7, 017	3, 186	3, 831
14, 209	4, 359	9, 850	5, 714	3, 143	2, 571	17, 950	7, 140	10, 810	3, 361	1, 344	2, 017
73, 473	38, 309	35, 164	24, 899	12, 495	12, 404	74, 110	30, 280	43, 830	16, 375	8, 019	8, 356
100, 316	9, 977	90, 339				23, 000	9, 290	13, 710	21, 788	8, 972	12, 816
1, 353	134	1, 219				470	190	280			
101, 669	10, 111	91, 558				23, 470	9, 480	13. 990	21, 788	8, 972	12, 816
12, 284	10, 901	1, 383	300		300	891	362	529	358	118	240
157	157					496	190	306			
						22	11	11	19	17	2
114, 110	21, 169	92, 941	300		300	24, 879	10, 043	14, 836	22, 165	9, 107	13, 058
205, 006	66, 927	138, 079	39, 732	23, 020	16, 712	170, 437	82, 636	87, 801	49, 373	22. 608	26, 765
205, 006	66, 927	138, 079	39, 732	23, 020	16, 712	170, 437	82, 636	87, 801	49, 373	22, 608	26, 765

suitable for chipping. Fine residues include sawdust, shavings, veneer clippings, wood substance removed in barking, screenings, and other material generally too small for chipping.

[2] Includes shingle mills, box board, small dimension, turnery and excelsior plants, and other similar establishments utilizing roundwood.

States and Coastal Alaska, by industry source, type of use, and section and region, 1952 [1]

Veneer				Cooperage			Pulp—fuel [3]	Other [2]			
Total	Fuel [3]	Fiber [4]	Other [5]	Total	Fuel [3]	Other [5]		Total	Fuel [3]	Fiber [4]	Other [5]
Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
1, 999	1, 580	417	2	745	744	1	13, 490	280	274	5	1
2, 786	2, 680		106	339	333	6	8, 360	246	29	10	207
4, 785	4, 260	417	108	1, 084	1, 077	7	21, 850	526	303	15	208
1, 200	638	266	296	435	424	11	12, 260	1, 746	1, 366		380
1, 604	1, 561		43	78	1	77	8, 840	1, 078	517		561
2, 804	2, 199	266	339	513	425	88	21, 100	2, 824	1, 883		941
1, 891	711	70	1, 110	94	94		15, 030	2, 790	2, 790		
2, 853	2, 818		35	114	79	35	10, 680	1, 470	1, 409		61
4, 744	3, 529	70	1. 145	208	173	35	25. 710	4, 260	4, 199		61
1, 969	1, 145	465	359	6, 106	6. 087	19	1. 533	362	362		
1, 795	1, 776		19	1, 659	154	1, 505	1, 255	1, 684	1, 325		359
3, 764	2, 921	465	378	7, 765	6, 241	1, 524	2, 788	2, 046	1, 687		359
184	154		30					4	4		
207	206		1					3	3		
391	360		31					7	7		
7, 243	4, 228	1, 218	1, 797	7, 380	7, 349	31	42, 313	5, 182	4, 796	5	381
9. 245	9, 041		204	2, 190	567	1, 623	29, 135	4, 481	3, 283	10	1, 188
16, 488	13, 269	1, 218	2, 001	9. 570	7, 916	1, 654	71, 448	9, 663	8, 079	15	1, 569

TABLE 54.—*Volume of plant residues from primary manufacturing used in the United States*

Section, region, and kind of material	Relation of used residues to total residues	All industries: Total	All industries: Fuel [3]	All industries: Fiber [4]	All industries: Other [5]	Lumber: Total	Lumber: Fuel [3]	Lumber: Fiber [4]	Lumber: Other [5]
	Percent	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
South:									
South Atlantic:									
Coarse	55	132, 157	122, 839	5, 865	3, 453	103, 445	101, 062	227	2, 156
Fine	43	111, 895	100, 915	132	10, 848	90, 054	79, 149	132	10, 773
Total	48	244, 052	223, 754	5, 997	14, 301	193, 499	180, 211	359	12, 929
Southeast:									
Coarse	51	151, 927	141, 836	3, 921	6, 170	113, 779	109, 910		3, 869
Fine	44	159, 040	143, 293	41	15, 706	117, 428	102, 555		14, 873
Total	47	310, 967	285, 129	3, 962	21, 876	231, 207	212, 465		18, 742
West Gulf:									
Coarse	65	80, 202	73, 817	1, 666	4, 719	65, 916	60, 819	405	4, 692
Fine	66	122, 383	119, 319		3, 064	100, 711	98, 096		2, 615
Total	66	202, 585	193, 136	1, 666	7, 783	166, 627	158, 915	405	7, 307
Total, South:									
Coarse	55	364, 286	338, 492	11, 452	14, 342	283, 140	271, 791	632	10, 717
Fine	48	393, 318	363, 527	173	29, 618	308, 193	279, 800	132	28, 261
Total	51	757, 604	702, 019	11, 625	43, 960	591, 333	551, 591	764	38, 978
West:									
Pacific Northwest:									
Douglas-fir subregion:									
Coarse	71	266, 753	187, 814	63, 463	15, 476	240, 767	168, 741	61, 463	10, 563
Fine	75	349, 398	320, 746	18, 253	10, 399	247, 942	244, 633		3, 309
Total	73	616, 151	508, 560	81, 716	25, 875	488, 709	413, 374	61, 463	13, 872
Pine subregion:									
Coarse	84	48, 891	43, 112	321	5, 458	48, 567	42, 875	321	5, 371
Fine	86	62, 324	61, 676	273	375	61, 026	60, 681		345
Total	85	111, 215	104, 788	594	5, 833	109, 593	103, 556	321	5, 716
Total Pacific Northwest:									
Coarse	72	315, 644	230, 926	63, 784	20, 934	289, 334	211, 616	61, 784	15, 934
Fine	77	411, 722	382, 422	18, 526	10, 774	308, 968	305, 314		3, 654
Total	75	727, 366	613, 348	82, 310	31, 708	598, 302	516, 930	61, 784	19, 588
California:									
Coarse	33	79, 922	61, 623	7, 970	10, 329	71, 742	56, 942	6, 761	8, 039
Fine	49	63, 526	61, 745		1, 781	61, 514	59, 971		1, 543
Total	39	143, 448	123, 368	7, 970	12, 110	133, 256	116, 913	6, 761	9, 582
Northern Rocky Mountain:									
Coarse	53	16, 315	9, 054	5, 782	1, 479	15, 968	8, 862	5, 645	1, 461
Fine	70	35, 049	33, 687		1, 362	34, 743	33, 381		1, 362
Total	63	51, 364	42, 741	5, 782	2, 841	50, 711	42, 243	5, 645	2, 823
Southern Rocky Mountain:									
Coarse	62	13, 052	10, 550		2, 502	13, 041	10, 539		2, 502
Fine	47	8, 086	5, 466		2, 620	8, 075	5, 455		2, 620
Total	55	21, 138	16, 016		5, 122	21, 116	15, 994		5, 122
Total, West:									
Coarse	58	424, 933	312, 153	77, 536	35, 244	390, 085	287, 959	74, 190	27, 936
Fine	71	518, 383	483, 320	18, 526	16, 537	413, 300	404, 121		9, 179
Total	64	943, 316	795, 473	96, 062	51, 781	803, 385	692, 080	74, 190	37, 115
United States:									
Coarse	59	984, 585	825, 135	91, 034	68, 416	806, 473	675, 554	75, 645	55, 274
Fine	60	1, 044, 418	924, 004	18, 709	101, 705	809, 159	719, 052	132	89, 975
Total	60	2, 029, 003	1, 749, 139	109, 743	170, 121	1, 615, 632	1, 394, 606	75, 777	145, 249
Coastal Alaska:									
Coarse	30	976	617		359	976	617		359
Fine	71	1, 843	1, 843			1, 843	1, 843		
Total	48	2, 819	2, 460		359	2, 819	2, 460		359
All regions:									
Coarse	59	985, 561	825, 752	91, 034	68, 775	807, 449	676, 171	75, 645	55, 633
Fine	70	1, 046, 261	925, 847	18, 709	101, 705	811, 002	720, 895	132	89, 975
Total	60	2, 031, 822	1, 751, 599	109, 743	170, 480	1, 618, 451	1, 397, 066	75, 777	145, 608

[1] Plant residues include only the material left over from converting logs, bolts, and other round timbers to the primary product, such as lumber, veneer, and pulp, and residues from planing mills integrated with sawmills whether or not the material is subsequently burned as fuel, chipped for pulp or used for various other purposes. Part consists of coarse residues such as slabs, edgings, trimmings, miscuts, veneer cores, cull pieces, and other material generally suitable for chipping, and part consists of fine residues such as sawdust, shavings, veneer clippings, wood substance removed in barking, screenings and other material generally too small for chipping.

and Coastal Alaska, by industry source, type of use, and section and region, 1952 [1]—Continued

Veneer				Cooperage			Pulp—fuel [3]	Other [2]			
Total	Fuel [3]	Fiber [4]	Other [5]	Total	Fuel [3]	Other [5]		Total	Fuel [3]	Fiber [4]	Other [5]
Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
16, 417	9, 596	5, 638	1, 183	333	333		9, 340	2, 622	2, 508		114
7, 655	7, 654		1	346	318	28	12, 120	1, 720	1, 674		46
24, 072	17, 250	5, 638	1, 184	679	651	28	21, 460	4, 342	4, 182		160
14, 907	8, 744	3, 921	2, 242	7, 393	7, 393		13, 800	2, 048	1, 989		59
14, 736	14, 695	41		4, 333	3, 875	458	20, 900	1, 643	1, 268		375
29, 643	23, 439	3, 962	2, 242	11, 726	11, 268	458	34, 700	3, 691	3, 257		434
3, 649	2, 361	1, 261	27	2, 791	2, 791		7, 140	706	706		
8, 670	8, 670			1, 599	1, 428	171	10, 810	593	315		278
12, 319	11, 031	1, 261	27	4, 390	4, 219	171	17, 950	1, 299	1, 021		278
34, 973	20, 701	10, 820	3, 452	10, 517	10, 517		30, 280	5, 376	5, 203		173
31, 061	31, 019	41	1	6, 278	5, 621	657	43, 830	3, 956	3, 257		699
66, 034	51, 720	10, 861	3, 453	16, 795	16, 138	657	74, 110	9, 332	8, 460		872
9, 977	3, 064	2, 000	4, 913				9, 290	6, 719	6, 719		
77, 420	56, 971	18, 253	2, 196				13, 710	10, 326	5, 432		4, 894
87, 397	60, 035	20, 253	7, 109				23, 000	17, 045	12, 151		4, 894
134	47		87				190				
1, 018	715	273	30				280				
1, 152	762	273	117				470				
10, 111	3, 111	2, 000	5, 000				9, 480	6, 719	6, 719		
78, 438	57, 686	18, 526	2, 226				13, 990	10, 326	5, 432		4, 894
88, 549	60, 797	20, 526	7, 226				23, 470	17, 045	12, 151		4, 894
7, 802	4, 303	1, 209	2, 290				362	16	16		
1, 149	990		159	300	255	45	529	34			34
8, 951	5, 293	1, 209	2, 449	300	255	45	891	50	16		34
157	2	137	18				190				
							306				
157	2	137	18				496				
							11				
							11				
							22				
18, 070	7, 416	3, 346	7, 308				10, 043	6, 735	6, 735		
79, 587	58, 676	18, 526	2, 385	300	255	45	14, 836	10, 360	5, 432		4, 928
97, 657	66, 092	21, 872	9, 693	300	255	45	24, 879	17, 095	12, 167		4, 928
60, 286	32, 345	15, 384	12, 557	17, 897	17, 866	31	82, 636	17, 293	16, 734	5	554
119, 893	98, 736	18, 567	2, 590	8, 768	6, 443	2, 325	87, 801	18, 797	11, 972	10	6, 815
180, 179	131, 081	33, 951	15, 147	26, 665	24, 309	2, 356	170, 437	36, 090	28, 706	15	7, 369
60, 286	32, 345	15, 384	12, 557	17, 897	17, 866	31	82, 636	17, 293	16, 734	5	554
119, 893	98, 736	18, 567	2, 590	8, 768	6, 443	2, 325	87, 801	18, 797	11, 972	10	6, 815
180, 179	131, 081	33, 951	15, 147	26, 665	24, 309	2, 356	170, 437	36, 090	28, 706	15	7, 369

[2] Includes shingle mills, box board, small dimension, turnery and excelsior plants, and other similar establishments utilizing roundwood.
[3] Volume used for either industrial or home fuel or both.
[4] Volume used for pulp, hardboard, or other fiber products.
[5] Includes material for cut stock, handles, brush blocks, chemical wood, box board, particle board, floor cleaning compound, wood flour, insulation, bedding for livestock, poultry litter, soil conditioner, metallurgical use, and other similar purposes.

TABLE 55.—*Volume of logging residues and unused plant residues from primary manufacturing in the*

Section and region	Total unused residues			Logging residues (coarse)					
	Total	Coarse	Fine	Total	Lumber	Veneer	Cooperage	Pulp	Other [2]
	Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
North:									
New England	88, 415	70, 249	18, 166	45, 290	35, 513	2, 749	165	5, 911	952
Middle Atlantic	109, 338	82, 971	26, 367	57, 823	49, 934	1, 805	460	2, 337	3, 287
Lake States	84, 741	67, 609	17, 132	63, 088	36, 852	2, 858	62	15, 513	7, 803
Central	67, 667	56, 310	11, 357	43, 128	36, 531	2, 129	3, 438	----------	1, 030
Plains	5, 301	4, 005	1, 296	3, 427	2, 559	338	----------	9	521
Total	355, 462	281, 144	74, 318	212, 756	161, 389	9, 879	4, 125	23, 770	13, 593
South:									
South Atlantic	452, 341	301, 698	150, 643	192, 462	156, 014	20, 512	1, 122	1, 372	13, 442
Southeast	679, 899	474, 852	205, 047	328, 517	221, 762	27, 358	14, 689	10, 656	54, 052
West Gulf	290, 218	228, 450	61, 768	184, 526	108, 126	12, 113	12, 465	5, 612	46, 210
Total	1, 422, 458	1, 005, 000	417, 458	705, 505	485, 902	59, 983	28, 276	17, 640	113, 704
West:									
Pacific Northwest:									
Douglas-fir subregion	418, 093	303, 528	114, 565	192, 577	140, 581	17, 756	168	27, 850	6, 222
Pine subregion	57, 867	47, 917	9, 950	38, 606	36, 641	257	----------	734	974
Total	475, 960	351, 445	124, 515	231, 183	177, 222	18, 013	168	28, 584	7, 196
California	394, 857	329, 053	65, 804	166, 706	150, 893	11, 685	221	1, 174	2, 733
Northern Rocky Mountain	63, 033	47, 726	15, 307	33, 082	30, 022	156	----------	598	2, 306
Southern Rocky Mountain	29, 814	20. 728	9, 086	12, 813	12, 232	----------	----------	----------	581
Total	963, 664	748, 952	214, 712	443, 784	370, 369	29, 854	389	30, 356	12, 816
United States	2, 741, 584	2, 035, 096	706, 488	1, 362, 045	1, 017, 660	99, 716	32, 790	71, 766	140, 113
Coastal Alaska	5, 141	4, 400	741	2, 128	2, 067	----------	----------	46	15
All regions	2, 746, 725	2, 039, 496	707, 229	1, 364, 173	1, 019, 727	99, 716	32, 790	71, 812	140, 128

[1] Logging residues refer to that part of growing stock inventory cut or killed in logging and left unused in the woods. Plant residues include only the material left over from converting logs, bolts, and other round timbers to the primary product such as lumber, veneer, pulp, etc., and residues from planing mills integrated with sawmills whether or not the material is subsequently burned as fuel, chipped for pulp or used for various other purposes. Coarse residues include slabs, edgings, trimmings, miscuts, veneer cores, cull pieces, and other material generally suitable for chipping. Fine residues include sawdust, shavings, veneer clippings, wood substance removed in barking, screenings, and other material generally too small for clipping.

United States and Coastal Alaska, by industry source, kind of material, and section and region, 1952 [1]

Unused plant residues														
All industries			Lumber			Veneer			Cooperage			Other [3]		
Total	Coarse	Fine	Total	Coarse	Fine	Total	Coarse	Fine	Total	Coarse	Fine	Total	Coarse	Fine
Thousand cu. ft.	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*	*Thousand cu. ft.*
43, 125	24, 959	18, 166	42, 770	24, 888	17, 882	238	34	204	59	18	41	58	19	39
51, 515	25, 148	26, 367	50, 982	24, 961	26, 021	226	90	136	157	65	92	150	32	118
21, 653	4, 521	17, 132	21, 090	4, 355	16, 735	166	16	150	44		44	353	150	203
24, 539	13, 182	11, 357	18, 975	9, 970	9, 005	263	54	209	4, 703	3, 062	1, 641	598	96	502
1, 874	578	1, 296	1, 821	563	1, 258	42	12	30				11	3	8
142, 706	68, 388	74, 318	135, 638	64, 737	70, 901	935	206	729	4, 963	3, 145	1, 818	1, 170	300	870
259, 879	109, 236	150, 643	254, 779	107, 336	147, 443	1, 341	581	760	2, 104	452	1, 652	1, 655	867	788
351, 382	146, 335	205, 047	339, 172	141, 978	197, 194	4, 208	2, 045	2, 163	4, 676	1, 174	3, 502	3, 326	1, 138	2, 188
105, 692	43, 924	61, 768	100, 416	42, 224	58, 192	1, 890	710	1, 180	1, 324	352	972	2, 062	638	1, 424
716, 953	299, 495	417, 458	694, 367	291, 538	402, 829	7, 439	3, 336	4, 103	8, 104	1, 978	6, 126	7, 043	2, 643	4, 400
225, 516	110, 951	114, 565	207, 854	108, 696	99, 156	12, 919		12, 919				4, 743	2, 253	2, 490
19, 261	9, 311	9, 950	19, 060	9, 311	9, 749	201		201						
244, 777	120, 262	124, 515	226, 914	118, 009	108, 905	13, 120		13, 120				4, 743	2, 253	2, 490
228, 151	162, 347	65, 804	224, 510	159, 146	65, 364	3, 333	3, 099	234				308	102	206
29, 951	14, 644	15, 307	29, 951	14, 644	15, 307									
17, 001	7, 915	9, 086	16, 982	7, 898	9, 084							19	17	2
519, 880	305, 168	214, 712	498, 357	299, 697	198, 660	16, 453	3, 099	13, 354				5, 070	2, 372	2, 698
1, 379, 539	673, 051	706, 488	1, 328, 362	655, 972	672, 390	24, 827	6, 641	18, 186	13, 067	5, 123	7, 944	13, 283	5, 315	7, 968
3, 013	2, 272	741	3, 013	2, 272	741									
1, 382, 552	675, 323	707, 229	1, 331, 375	658, 244	673, 131	24, 827	6, 641	18, 186	13, 067	5, 123	7, 944	13, 283	5, 315	7, 968

[2] Includes logging residues originating in such operations as poles, piling, posts, hewn ties, round mine timbers, fuelwood, and miscellaneous logging industries. Volumes are in cubic feet roundwood excluding bark.

[3] Includes shingle mills, box board, small dimension, turnery and excelsior plants, and other similar establishments utilizing roundwood.

TABLE 56.—*Comparison of net annual growth with timber cut from growing stock and live sawtimber on commercial forest land in the United States and Coastal Alaska, by species group, 1952* [1]

Species group	Growing stock			Sawtimber		
	Timber cut	Growth [2]	Relation of growth to timber cut	Timber cut	Growth [2]	Relation of growth to growth cut
Eastern species:						
Softwoods:	*Million cu. ft.*	*Million cu. ft.*	*Percent*	*Million bd.-ft.*	*Million bd.-ft.*	*Percent*
White, red, and jack pine	257	270	105	972	906	93
Southern yellow pines	3, 029	3, 483	115	11, 610	14, 155	122
Spruce and fir	243	291	120	668	742	111
Other softwoods	217	341	157	841	1, 167	139
Total softwoods	3, 746	4, 385	117	14, 091	16, 970	120
Hardwoods:						
Soft hardwoods:						
Yellow-poplar	217	289	133	988	948	96
Other soft hardwoods	1, 055	2, 290	217	3, 892	6, 041	155
Total	1, 272	2, 579	203	4, 880	6, 989	143
Hard hardwoods:						
Oaks	1, 292	2, 478	192	4, 894	7, 316	149
Beech, yellow birch, hard maple	325	718	221	1, 290	1, 877	146
Other hard hardwoods	358	1, 306	365	1, 150	2, 939	256
Total	1, 975	4, 502	228	7, 334	12, 132	165
Total hardwoods	3, 247	7, 081	218	12, 214	19, 121	156
Total, eastern species	6, 993	11, 466	164	26, 305	36, 091	137
Western species:						
Softwoods:						
Douglas-fir	1, 966	902	46	11, 962	4, 431	37
Ponderosa and Jeffrey pine [3]	605	479	79	3, 603	1, 841	51
Western hemlock	377	237	63	2, 225	1, 038	47
White and sugar pine	97	100	103	609	535	88
Redwood	163	77	47	987	396	40
Other softwoods	533	833	156	3, 069	2, 800	91
Total softwoods	3, 741	2, 628	70	22, 455	11, 041	49
Hardwoods	23	149	648	80	265	331
Total, western species	3, 764	2, 777	74	22, 535	11, 306	50
All softwoods	7, 487	7, 013	94	36, 546	28, 011	77
All hardwoods	3, 270	7, 230	221	12, 294	19, 386	158
All species	10, 757	14, 243	132	48, 840	47, 397	97

[1] Growing stock volumes are in net cubic feet excluding bark. Sawtimber volumes are in net board-feet log scale, International ¼-inch rule. Timber cut refers to net inventory volume cut or killed in logging and converted to timber products or left as logging residues.

[2] The considerable excess of cut over growth for most western softwoods is not entirely due to overcutting. Growth is at a low level partly because 40 percent of the commercial forest area consists of old-growth timber that contributes little to net annual growth.

[3] Estimates of net growth for ponderosa and Jeffrey pine exclude 4 million cubic feet and 16 million board-feet of ponderosa pine in the Plains Region and combined here with other eastern softwoods. Total net annual growth of ponderosa and Jeffrey pine in the United States is 483 million cubic feet and 1,857 million board-feet.

TABLE 57.—*Comparison of net annual growth with timber cut from live sawtimber on commercial forest land in the United States and Coastal Alaska, by softwoods and hardwoods and section and region, 1952* [1]

Section and region	All species			Softwood			Hardwood		
	Timber cut	Growth	Relation of growth to timber cut	Timber cut	Growth [2]	Relation of growth to timber cut	Timber cut	Growth	Relation of growth to timber cut
	Million bd.-ft.	*Million bd.-ft.*	*Percent*	*Million bd.-ft.*	*Million bd.-ft.*	*Percent*	*Million bd.-ft.*	*Million bd.-ft.*	*Percent*
North:									
New England	1,768	1,857	105	1,381	914	66	387	943	244
Middle Atlantic	1,795	3,160	176	508	470	92	1,287	2,690	209
Lake States	1,240	2,693	217	384	802	209	856	1,891	221
Central	1,809	3,963	219	85	249	293	1,724	3,714	215
Plains	94	401	426	12	40	333	82	361	440
Total	6,706	12,074	180	2,370	2,475	104	4,336	9,599	221
South:									
South Atlantic	5,352	6,880	128	3,360	3,670	109	1,992	3,210	161
Southeast	9,411	10,035	107	5,724	6,679	117	3,687	3,356	91
West Gulf	4,836	7,102	147	2,637	4,146	157	2,199	2,956	134
Total	19,599	24,017	122	11,721	14,495	124	7,878	9,522	121
West:									
Pacific Northwest:									
Douglas-fir subregion	12,221	5,149	42	12,169	5,010	41	52	139	267
Pine subregion	2,050	828	40	2,050	824	40	(3)	4	
Total	14,271	5,977	42	14,219	5,834	41	52	143	275
California	5,724	2,939	51	5,704	2,895	51	20	44	220
Northern Rocky Mountain	1,899	1,534	81	1,897	1,508	79	2	26	1,300
Southern Rocky Mountain	555	728	131	549	677	123	6	51	850
Total	22,449	11,178	50	22,369	10,914	49	80	264	330
United States	48,754	47,269	97	36,460	27,884	76	12,294	19,385	158
Coastal Alaska	86	128	149	86	127	148		1	
All regions	48,840	47,397	97	36,546	28,011	77	12,294	19,386	158

[1] Volumes are in net board-feet log scale, International ¼-inch rule. Timber cut refers to net inventory volume cut or killed in logging and converted to timber products or left as logging residues.
[2] The considerable excess of cut over growth for most western softwoods is not entirely due to overcutting. Growth is at a low level partly because 40 percent of the commercial forest area consists of old-growth timber which contributes little to net annual growth.
[3] Less than 0.5 million board-feet.

TABLE 58.—*Comparison of net annual growth with timber cut from live sawtimber on commercial forest land in Eastern United States, by species group and section and region, 1952* [1]

Section and region	Total, all species	Softwoods					Total, hardwoods	Soft hardwoods			Hard hardwoods			
		Total	White, red, and jack pine	Southern yellow pines	Spruce and fir	Other softwoods		Total	Yellow-poplar	Other soft hardwoods	Total	Oaks	Beech, yellow birch, and hard maple	Other hard hardwoods
North:														
New England:														
Timber cut million bd.-ft.	1,768	1,381	618	8	560	195	387	87	1	86	300	41	245	14
Growth do	1,857	914	298	2	426	188	943	75	5	70	868	125	534	209
Relation of growth to cut percent	105	66	48	25	76	96	244	86	500	81	289	305	218	1,493
Middle Atlantic:														
Timber cut million bd.-ft.	1,795	508	149	178	64	117	1,287	294	77	217	993	486	408	99
Growth do	3,160	470	124	107	67	172	2,690	546	155	391	2,144	983	733	428
Relation of growth to cut percent	176	92	83	60	105	147	209	186	201	180	216	202	180	432
Lake States:														
Timber cut million bd.-ft.	1,240	384	162		44	178	856	259		259	597	157	333	107
Growth do	2,693	802	417		248	137	1,891	1,239		1,239	652	440	158	54
Relation of growth to cut percent	217	209	257		564	77	221	478		478	109	280	47	50
Central:														
Timber cut million bd.-ft.	1,809	85	(2)	61		24	1,724	380	97	283	1,344	899	192	253
Growth do	3,963	249	6	184		59	3,714	905	163	742	2,809	1,872	297	640
Relation of growth to cut percent	219	293		302		246	215	238	168	262	209	208	155	253
Plains:														
Timber cut million bd.-ft.	94	12		10		2	82	30		30	52	31	(2)	21
Growth do	401	40		24		[3] 16	361	236		236	125	66		59
Relation of growth to cut percent	426	333		240		800	440	787		787	240	213		281
Total, North:														
Timber cut million bd.-ft.	6,706	2,370	929	257	668	516	4,336	1,050	175	875	3,286	1,614	1,178	494
Growth do	12,074	2,475	845	317	741	572	9,599	3,001	323	2,678	6,598	3,486	1,722	1,390
Relation of growth to cut percent	180	104	91	123	111	111	221	286	184	306	201	216	146	281

See footnotes at end of table.

TABLE 58.—*Comparison of net annual growth with timber cut from live sawtimber on commercial forest land in Eastern United States, by species group and section and region, 1952* [1]—Continued

Section and region	Total, all species	Softwoods					Total, hardwoods	Soft hardwoods			Hard hardwoods			
		Total	White, red, and jack pine	Southern yellow pines	Spruce and fir	Other softwoods		Total	Yellow-poplar	Other soft hardwoods	Total	Oaks	Beech, yellow birch, and hard maple	Other hard hardwoods
South:														
South Atlantic:														
Timber cut.......million bd.-ft..	5, 352	3, 360	30	3, 228	(2)	102	1, 992	1, 062	400	662	930	804	23	103
Growth..................do....	6, 880	3, 670	41	3, 493	1	135	3, 210	1, 401	383	1, 018	1, 809	1, 334	38	437
Relation of growth to cut................percent..	128	109	137	108	....	132	161	132	96	154	194	166	165	424
Southeast:														
Timber cut.......million bd.-ft..	9, 411	5, 724	13	5, 546	....	165	3, 687	1, 913	409	1, 504	1, 774	1, 405	71	298
Growth..................do....	10, 035	6, 679	20	6, 378	....	281	3, 356	1, 493	239	1, 254	1, 863	1, 257	73	533
Relation of growth to cut................percent..	107	117	154	115	....	170	91	78	58	83	105	89	103	179
West Gulf:														
Timber cut.......million bd.-ft..	4, 836	2, 637	....	2, 579	....	58	2, 199	855	4	851	1, 344	1, 071	18	255
Growth..................do....	7, 102	4, 146	....	3, 967	....	179	2, 956	1, 094	3	1, 091	1, 862	1, 239	44	579
Relation of growth to cut................percent..	147	157	....	154	....	308	134	128	75	128	138	116	244	227
Total, South:														
Timber cut........million bd.-ft..	19, 599	11, 721	43	11, 353	(2)	325	7, 878	3, 830	813	3, 017	4, 048	3, 280	112	656
Growth....................do....	24, 017	14, 495	61	13, 838	1	595	9, 522	3, 988	625	3, 363	5, 534	3, 830	155	1, 549
Relation of growth to cut.................percent..	122	124	142	122	....	183	121	104	77	111	137	117	138	236
Total, Eastern United States:														
Timber cut........million bd.-ft..	26, 305	14, 091	972	11, 610	668	841	12, 214	4, 880	988	3, 892	7, 334	4, 894	1, 290	1, 150
Growth....................do....	36, 091	16, 970	906	14, 155	742	1, 167	19, 121	6, 989	948	6, 041	12, 132	7, 316	1, 877	2, 939
Relation of growth to cut.................percent..	137	120	93	122	111	139	156	143	96	155	165	149	146	256

[1] Volumes are in net board-feet log scale, International 1/4-inch rule. Timber cut refers to net inventory volume cut or killed in logging and converted to timber products or left as logging residues.
[2] Less than 0.5 million board-feet.
[3] Net growth of ponderosa pine. Total net growth of ponderosa and Jeffrey pine in the United States is 1,857 million board-feet including 16 million board-feet in the Plains Region.

TABLE 59.—*Comparison of net annual growth with timber cut from live sawtimber on commercial forest land in Western United States and Coastal Alaska, by species group and section and region, 1952* [1]

Section and region	Total, all species	Softwoods							Hardwoods
		Total	Douglas-fir	Ponderosa and Jeffrey pine	Western hemlock	White and sugar pine	Redwood	Other softwoods	
West:									
Pacific Northwest:									
Douglas-fir subregion:									
Timber cut............million bd.-ft..	12, 221	12, 169	8, 827	149	2, 172	23	....	998	52
Growth........................do....	5, 149	5, 010	3, 022	57	911	98	....	922	139
Relation of growth to cut....percent..	42	41	34	38	42	426	....	92	267
Pine subregion:									
Timber cut............million bd.-ft..	2, 050	2, 050	366	1, 348	21	40	....	275	(2)
Growth........................do....	828	824	171	439	20	21	....	173	4
Relation of growth to cut....percent..	40	40	47	32	95	52	....	63	....
Total:									
Timber cut..........million bd.-ft..	14, 271	14, 219	9, 193	1, 497	2, 193	63	....	1, 273	52
Growth [3]....................do....	5, 977	5, 834	3, 193	496	931	119	....	1, 095	143
Relation of growth to cut..percent..	42	41	35	33	42	189	....	86	275
California:									
Timber cut..............million bd.-ft..	5, 724	5, 704	2, 333	1, 274	2	324	987	784	20
Growth........................do....	2, 939	2, 895	787	553	9	207	396	943	44
Relation of growth to cut......percent..	51	51	34	43	450	64	40	120	220
Northern Rocky Mountain:									
Timber cut..............million bd.-ft..	1, 899	1, 897	393	475	9	222	....	798	2
Growth........................do....	1, 534	1, 508	388	368	27	209	....	516	26
Relation of growth to cut......percent..	81	79	99	77	300	94	....	65	1, 300
Southern Rocky Mountain:									
Timber cut..............million bd.-ft..	555	549	43	357	....	....	....	149	6
Growth........................do....	728	677	63	424	....	....	....	190	51
Relation of growth to cut......percent..	131	123	146	119	....	....	....	128	850
Total, West:									
Timber cut................million bd.-ft..	22, 449	22, 369	11, 962	3, 603	2, 204	609	987	3, 004	80
Growth..........................do....	11, 178	10, 914	4, 431	[4] 1, 841	967	535	396	2, 744	264
Relation of growth to cut........percent..	50	49	37	51	44	88	40	91	330
Coastal Alaska:									
Timber cut................million bd.-ft..	86	86	....	....	21	....	....	65	....
Growth..........................do....	128	127	....	....	71	....	....	56	1
Relation of growth to cut........percent..	149	148	....	....	338	....	....	86	....
Total Western U. S. and Coastal Alaska:									
Timber cut................million bd.-ft..	22, 535	22, 455	11, 962	3, 603	2, 225	609	987	3, 069	80
Growth..........................do....	11, 306	11, 041	4, 431	[4] 1, 841	1, 038	535	396	2, 800	265
Relation of growth to cut........percent..	50	49	37	51	47	88	40	91	331

[1] Volumes are in net board-feet log scale, International ¼-inch rule. Timber cut refers to net inventory volume cut or killed in logging and converted to timber products or left as logging residues.
[2] Less than 0.5 million board-feet.
[3] The considerable excess of cut over growth for the principal softwoods in the Pacific Northwest and California is not entirely due to overcutting. Growth is at a low level partly because a comparatively high proportion of the commercial forest area consists of old-growth timber which contributes little to net annual growth.
[4] Excludes 16 million board-feet net growth of ponderosa pine in the Plains Region. Total net growth of ponderosa and Jeffrey pine in the United States is 1,857 million board-feet.

TABLE 60.—*Comparison of net annual growth with timber cut from growing stock on commercial forest land in the United States and Coastal Alaska, by softwoods, hardwoods, and section and region, 1952* [1]

Section and region	All species			Softwood			Hardwood		
	Timber cut	Growth	Relation of growth to timber cut	Timber cut	Growth [2]	Relation of growth to timber cut	Timber cut	Growth	Relation of growth to timber cut
	Million cu. ft.	*Million cu. ft.*	*Percent*	*Million cu. ft.*	*Million cu. ft.*	*Percent*	*Million cu. ft.*	*Million cu. ft.*	*Percent*
North:									
New England	500	878	176	361	291	81	139	587	422
Middle Atlantic	470	1, 357	289	130	156	130	340	1, 201	353
Lake States	537	1, 180	220	188	319	170	349	861	247
Central	405	1, 128	278	17	46	270	388	1, 082	279
Plains	28	116	414	4	9	225	24	107	446
Total	1, 940	4, 659	240	700	821	117	1, 240	3, 838	310
South:									
South Atlantic	1, 455	1, 908	131	916	969	106	539	939	174
Southeast	2, 405	3, 056	127	1, 479	1, 714	116	926	1, 342	145
West Gulf	1, 193	1, 843	154	651	881	135	542	962	177
Total	5, 053	6, 807	135	3, 046	3, 564	117	2, 007	3, 243	162
West:									
Pacific Northwest:									
Douglas-fir subregion	2, 031	998	49	2, 022	943	47	9	55	611
Pine subregion	359	329	92	359	329	92	(3)	----	----
Total	2, 390	1, 327	55	2, 381	1, 272	53	9	55	611
California	932	595	64	921	539	59	11	56	509
Northern Rocky Mountain	329	603	183	328	591	180	1	12	1, 200
Southern Rocky Mountain	100	220	220	98	194	198	2	26	1, 300
Total	3, 751	2, 745	73	3, 728	2, 596	70	23	149	648
United States	10, 744	14, 211	132	7, 474	6, 981	93	3, 270	7, 230	221
Coastal Alaska	13	32	246	13	32	246	----	(3)	----
All regions	10, 757	14, 243	132	7, 487	7, 013	94	3, 270	7, 230	221

[1] Volumes are in net cubic feet excluding bark. Timber cut refers to net inventory volume cut or killed in logging and converted to timber products or left as logging residues.

[2] The considerable excess of cut over growth in the Pacific Northwest and California is not entirely due to overcutting. Growth is at a low level partly because a comparatively high proportion of the commercial forest area consists of old-growth timber which contributes little to net annual growth.

[3] Less than 0.5 million cubic feet.

TABLE 61.—*Comparison of net annual growth with timber cut from growing stock on commercial forest land in Eastern United States, by species group and section and region, 1952* [1]

Section and region	Total, all species	Softwoods					Total, hardwoods	Soft hardwoods			Hard hardwoods			
		Total	White, red, and jack pine	Southern yellow pines	Spruce and fir	Other softwoods		Total	Yellow-poplar	Other soft hardwoods	Total	Oaks	Beech, yellow birch, and hard maple	Other hard hardwoods
North:														
New England:														
Timber cut.......million cu. ft..	500	361	153	2	157	49	139	38	(2)	38	101	17	80	4
Growth.......do....	878	291	83	1	145	62	587	76	1	75	511	75	252	184
Relation of growth to cut percent..	176	81	54	50	92	126	422	200	--------	197	506	441	315	4,600
Middle Atlantic:														
Timber cut.......million cu. ft..	470	130	31	54	18	27	340	74	19	55	266	132	98	36
Growth.......do....	1,357	156	32	48	23	53	1,201	217	63	154	984	436	272	276
Relation of growth to cut percent..	289	120	103	89	128	196	283	293	332	280	370	330	278	767
Lake States:														
Timber cut.......million cu. ft..	537	188	64	--------	68	56	349	169	--------	169	180	59	90	31
Growth.......do....	1,180	319	139	--------	122	58	861	621	--------	621	240	148	77	15
Relation of growth to cut percent..	220	170	217	--------	179	104	247	367	--------	367	133	251	86	48
Central:														
Timber cut.......million cu. ft..	405	17	(2)	10	--------	7	388	69	16	53	319	190	32	97
Growth.......do....	1,128	46	(2)	33	--------	13	1,082	245	40	205	837	536	70	231
Relation of growth to cut percent..	278	270	--------	330	--------	186	279	355	250	387	262	282	219	238
Plains:														
Timber cut.......million cu. ft..	28	4	--------	2	--------	2	24	7	--------	7	17	9	(2)	8
Growth.......do....	116	9	--------	5	--------	[3] 4	107	63	--------	63	44	20	--------	24
Relation of growth to cut percent..	414	225	--------	250	--------	200	446	900	--------	900	259	222	--------	300
Total, North:														
Timber cut.........million cu. ft..	1,940	700	248	68	243	141	1,240	357	35	322	883	407	300	176
Growth.........do....	4,659	821	254	87	290	190	3,838	1,222	104	1,118	2,616	1,215	671	730
Relation of growth to cut percent..	240	117	102	128	119	135	310	342	297	347	296	298	224	415
South:														
South Atlantic:														
Timber cut.......million cu. ft..	1,455	916	6	884	(2)	26	539	267	91	176	272	237	4	31
Growth.......do....	1,908	969	11	920	1	37	939	401	111	290	538	384	11	143
Relation of growth to cut percent..	131	106	183	104	--------	142	174	150	122	165	198	162	275	461
Southeast:														
Timber cut.......million cu. ft..	2,405	1,479	3	1,438	--------	38	926	450	90	360	476	376	17	83
Growth.......do....	3,056	1,714	5	1,630	--------	79	1,342	606	73	533	736	486	23	227
Relation of growth to cut percent..	127	116	167	113	--------	208	145	135	81	148	155	129	135	273
West Gulf:														
Timber cut.......million cu. ft..	1,193	651	--------	639	--------	12	542	198	1	197	344	272	4	68
Growth.......do....	1,843	881	--------	846	--------	35	962	350	1	349	612	393	13	206
Relation of growth to cut percent..	154	135	--------	132	--------	292	177	177	100	177	178	144	325	303
Total, South:														
Timber cut.........million cu. ft..	5,053	3,046	9	2,961	(2)	76	2,007	915	182	733	1,092	885	25	182
Growth.........do....	6,807	3,564	16	3,396	1	151	3,243	1,357	185	1,172	1,886	1,263	47	576
Relation of growth to cut percent..	135	117	178	115	--------	199	162	148	102	160	173	143	188	316
Total, Eastern United States:														
Timber cut.........million cu. ft..	6,993	3,746	257	3,029	243	217	3,247	1,272	217	1,055	1,975	1,292	325	358
Growth.........do....	11,466	4,385	270	3,483	291	341	7,081	2,579	289	2,290	4,502	2,478	718	1,306
Relation of growth to cut percent..	164	117	105	115	120	157	218	203	133	217	228	192	221	365

[1] Volumes are in net cubic feet, excluding bark. Timber cut refers to net inventory volume cut or killed in logging and converted to timber products or left as logging residues.

[2] Less than 0.5 million cubic feet.

[3] Net growth of ponderosa pine. Total net annual growth of ponderosa and Jeffrey pine in the United States is 483 million cubic feet including 4 million cubic feet in the Plains Region.

TABLE 62.—*Comparison of net annual growth with timber cut from growing stock on commercial forest land in Western United States and Coastal Alaska, by species group and section and region, 1952* [1]

Section and region	Total, all species	Softwoods							Hardwoods
		Total	Douglas-fir	Ponderosa and Jeffrey pine	Western hemlock	White and sugar pine	Redwood	Other softwoods	
West:									
Pacific Northwest:									
Douglas-fir subregion:									
Timber cut.....million cu. ft..	2,031	2,022	1,456	24	368	4	-----	170	9
Growth.....do....	998	943	529	8	205	14	-----	187	55
Relation of growth to cut....percent..	49	47	36	33	56	350	-----	110	611
Pine subregion:									
Timber cut.....million cu. ft..	359	359	64	235	3	7	-----	50	(2)
Growth.....do....	329	329	60	159	3	8	-----	99	-----
Relation of growth to cut....percent..	92	92	94	68	100	114	-----	198	-----
Total:									
Timber cut.....million cu. ft..	2,390	2,381	1,520	259	371	11	-----	220	9
Growth [3].....do....	1,327	1,272	589	167	208	22	-----	286	55
Relation of growth to cut..percent..	56	53	39	64	56	200	-----	130	611
California:									
Timber cut.....million cu. ft..	932	921	371	206	1	51	163	129	11
Growth [3].....do....	595	539	144	99	2	32	77	185	56
Relation of growth to cut.....percent..	64	59	39	48	200	63	47	143	509
Northern Rocky Mountain:									
Timber cut.....million cu. ft..	329	328	67	81	1	35	-----	144	1
Growth.....do....	603	591	150	108	9	46	-----	278	12
Relation of gowth to cut.....percent..	183	180	224	133	900	131	-----	193	1,200
Southern Rocky Mountain:									
Timber cut.....million cu. ft..	100	98	8	59				31	2
Growth.....do....	220	194	19	105	-----	(2)	-----	70	26
Relation of growth to cut.....percent..	220	197	237	178	-----	-----	-----	226	1,300
Total, West:									
Timber cut.....million cu. ft..	3,751	3,728	1,966	605	373	97	163	524	23
Growth.....do....	2,745	2,596	902	[4] 479	219	100	77	819	149
Relation of growth to cut.....percent..	73	70	46	79	59	103	47	156	648
Coastal Alaska:									
Timber cut.....million cu. ft..	13	13			4			9	-----
Growth.....do....	32	32	-----	-----	18	-----	-----	14	(2)
Relation of growth to cut.....percent..	246	246	-----	-----	450	-----	-----	156	-----
Total, Western United States and Coastal Alaska:									
Timber cut.....million cu. ft..	3,764	3,741	1,966	605	377	97	163	533	23
Growth.....do....	2,777	2,628	902	[4] 479	237	100	77	833	149
Relation of growth to cut.....percent..	74	70	46	79	63	103	47	156	648

[1] Volumes are in net cubic feet, excluding bark. Timber cut refers to net inventory volume cut or killed in logging and converted to timber products or left as logging residues.

[2] Less than 0.5 million cubic feet.

[3] The considerable excess of cut over growth for the principal softwoods in the Pacific Northwest and California is not entirely due to overcutting. Growth is at a low level partly because a comparatively high proportion of the commercial forest area consists of old-growth timber which contributes little to net annual growth.

[4] Excludes 4 million cubic feet net growth of ponderosa pine in the Plains Region. Total net annual growth of ponderosa and Jeffrey pine in the United States is 483 million cubic feet.

TABLE 63.—*Area burned on commercial and noncommercial forest land requiring protection in the United States and Coastal Alaska, by ownership class and section and region, 1952*

Section and region	All ownerships	Federal ownership or trusteeship					State, county, and municipal	Private
		Total	National forest	Indian	Bureau of Land Management	Other		
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
North:								
New England	36,071	-----	-----	-----	-----	-----	71	36,000
Middle Atlantic	748,000	4,000	4,000	-----	-----	-----	21,000	723,000
Lake States	41,636	3,160	1,218	1,627	40	275	5,733	32,743
Central	2,792,168	50,163	33,155	-----	-----	17,008	7,062	2,734,943
Plains	1,155,119	64,105	605	30,500	-----	33,000	18,771	1,072,243
Total	4,772,994	121,428	38,978	32,127	40	50,283	52,637	4,598,929
South:								
South Atlantic	614,635	45,017	27,300	4,428	-----	13,289	8,919	560,699
Southeast	7,381,010	91,331	39,548	20,000	5,000	26,783	181,447	7,108,232
West Gulf	1,676,275	42,869	8,299	1,920	4,589	28,061	15,835	1,617,571
Total	9,671,920	179,217	75,147	26,348	9,589	68,133	206,201	9,286,502
West:								
Pacific Northwest	65,698	13,553	9,487	297	3,767	2	3,917	48,228
California	143,726	26,302	13,977	1,805	10,453	67	1,050	116,374
Northern Rocky Mountain	33,274	7,165	4,703	1,217	1,072	173	3,017	23,092
Southern Rocky Mountain	22,913	13,979	6,110	2,253	5,489	127	191	8,743
Total	265,611	60,999	34,277	5,572	20,781	369	8,175	196,437
United States	14,710,525	361,644	148,402	64,047	30,410	118,785	267,013	14,081,868
Coastal Alaska	631	630	628	-----	2	-----	-----	1
All regions	[1] 14,711,156	362,274	149,030	64,047	30,412	118,785	267,013	14,081,869

[1] About 1,501,000 acres of the total area burned consisted of noncommercial and nonforest land, the latter in California and North Dakota. This area was distributed as follows: 1,189,000 acres in the North, 158,000 acres in the South, and 154,000 acres in the West.

TABLE 64.—*Annual mortality of growing stock and live sawtimber on commercial forest land in the United States and Coastal Alaska, by softwoods and hardwoods, cause, and section and region, 1952* [1]

GROWING STOCK

Section and region	All species					Softwood					Hardwood				
	Total	Fire	Insects	Disease	Other [2]	Total	Fire	Insects	Disease	Other [2]	Total	Fire	Insects	Disease	Other [2]
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
North:															
New England	298	4	23	218	53	99	1	10	57	31	199	3	13	161	22
Middle Atlantic	233	8	8	39	178	64	1	2	24	37	169	7	6	15	141
Lake States	485	2	34	166	283	122	1	6	19	96	363	1	28	147	187
Central	102	21		29	52	4	1		1	2	98	20		28	50
Plains	28	1	(3)	9	18	2	(3)	(3)	(3)	2	26	1	(3)	9	16
Total	1,146	36	65	461	584	291	4	18	101	168	855	32	47	360	416
South:															
South Atlantic	95	16	23	20	36	64	11	19	11	23	31	5	4	9	13
Southeast	314	71	42	40	161	149	36	37	16	60	165	35	5	24	101
West Gulf	220	39	47	13	121	85	14	42	2	27	135	25	5	11	94
Total	629	126	112	73	318	298	61	98	29	110	331	65	14	44	208
West:															
Pacific Northwest:															
Douglas-fir subregion	551	34	225	62	230	537	34	225	62	216	14				14
Pine subregion	196		89	16	91	196		89	16	91					
Total	747	34	314	78	321	733	34	314	78	307	14				14
California	359	21	228	45	65	336	21	228	37	50	23	(3)		8	15
Northern Rocky Mountain	308	7	158	36	107	306	7	158	36	105	2	(3)	(3)	(3)	2
Southern Rocky Mountain	200	11	66	31	92	179	11	60	24	84	21	(3)	6	7	8
Total	1,614	73	766	190	585	1,554	73	760	175	546	60	(3)	6	15	39
United States	3,389	235	943	724	1,487	2,143	138	876	305	824	1,246	97	67	419	663
Coastal Alaska	100	1	27	49	23	100	1	27	49	23	(3)	(3)		(3)	(3)
All regions	3,489	236	970	773	1,510	2,243	139	903	354	847	1,246	97	67	419	663

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Section and region	All species					Softwood					Hardwood				
	Total	Fire	Insects	Disease	Other [2]	Total	Fire	Insects	Disease	Other [2]	Total	Fire	Insects	Disease	Other [2]
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
North:															
New England	645	7	53	475	110	268	1	42	164	61	377	6	11	311	49
Middle Atlantic	354	10	24	107	213	115	2	8	75	30	239	8	16	32	183
Lake States	698	3	20	193	482	209	2	6	34	167	489	1	14	159	315
Central	312	46		111	155	13	3		3	7	299	43		108	148
Plains	70	5	2	28	35	5	(4)	1	1	3	65	5	1	27	32
Total	2,079	71	99	914	995	610	8	57	277	268	1,469	63	42	637	727
South:															
South Atlantic	267	47	72	68	80	191	36	65	45	45	76	11	7	23	35
Southeast	841	154	156	124	407	455	91	146	51	167	386	63	10	73	240
West Gulf	660	93	184	41	342	326	45	178	9	94	334	48	6	32	248
Total	1,768	294	412	233	829	972	172	389	105	306	796	122	23	128	523
West:															
Pacific Northwest:															
Douglas-fir subregion	3,105	189	1,313	369	1,234	3,056	189	1,313	369	1,185	49				49
Pine subregion	932	4	422	75	431	932	4	422	75	431					
Total	4,037	193	1,735	444	1,665	3,988	193	1,735	444	1,616	49				49
California	1,865	131	1,358	204	172	1,811	129	1,358	182	142	54	2		22	30
Northern Rocky Mountain	1,475	27	833	134	481	1,472	27	833	134	478	3		(4)	(4)	3
Southern Rocky Mountain	906	63	298	146	399	849	63	283	122	381	57	(4)	15	24	18
Total	8,283	414	4,224	928	2,717	8,120	412	4,209	882	2,617	163	2	15	46	100
United States	12,130	779	4,735	2,075	4,541	9,702	592	4,655	1,264	3,191	2,428	187	80	811	1,350
Coastal Alaska	392	2	98	204	88	392	2	98	204	88	(4)	(4)		(4)	(4)
All regions	12,522	781	4,833	2,279	4,629	10,094	594	4,753	1,468	3,279	2,428	187	80	811	1,350

[1] Mortality in cubic feet, excluding bark, and in board-feet log scale, International ¼-inch rule. Estimates represent current level of mortality indicated by trends over a long period of years, as determined in 1952.

[2] Weather, animals, suppression, etc.

[3] Less than 0.5 million cubic feet.

[4] Less than 0.5 million board-feet.

TABLE 65.—*Mortality in 1952, and estimated growth loss and growth impact of damage to growing stock and live sawtimber during 1952, on commercial forest land in the United States and Coastal Alaska, by cause and section and region* [1]

GROWING STOCK

Section and region	All causes				Fire			Disease			Insects			Other [2]		
	Mortality	Salvage [3]	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
North:																
New England	298	6	515	813	4	3	7	218	429	647	23	43	66	53	40	93
Middle Atlantic	233	33	683	916	8	38	46	39	511	550	8	59	67	178	75	253
Lake States	485	61	1,355	1,840	2	4	4	166	508	674	34	136	170	283	709	992
Central	102	45	530	632	21	101	122	29	265	294	------	92	92	52	72	124
Plains	28	5	76	104	1	13	14	9	25	34	------	3	3	18	35	53
Total	1,146	150	3,159	4,305	36	157	193	461	1,738	2,199	65	333	398	584	931	1,515
South:																
South Atlantic	95	67	517	612	16	89	105	20	326	346	23	95	118	36	7	43
Southeast	314	118	2,100	2,414	71	852	923	40	1,102	1,142	42	97	139	161	49	210
West Gulf	220	53	753	973	39	311	350	13	346	359	47	59	106	121	37	158
Total	629	238	3,370	3,999	126	1,252	1,378	73	1,774	1,847	112	251	363	318	93	411
West:																
Pacific Northwest	747	339	408	1,155	34	27	61	78	192	270	314	122	436	321	67	388
California	359	17	207	566	21	11	32	45	146	191	228	16	244	65	34	99
Northern Rocky Mountain	329	18	294	623	7	3	10	36	252	288	188	22	210	98	17	115
Southern Rocky Mountain	200	7	143	343	11	1	12	31	70	101	66	20	86	92	52	144
Total	1,635	381	1,052	2,687	73	42	115	190	660	850	796	180	976	576	170	746
United States	3,410	769	7,581	10,991	235	1,451	1,686	724	4,172	4,896	973	764	1,737	1,478	1,194	2,672
Coastal Alaska	100	(4)	118	218	1	1	2	49	103	152	27	14	41	23	------	23
All regions	3,510	769	7,699	11,209	236	1,452	1,688	773	4,275	5,048	1,000	778	1,778	1,501	1,194	2,695

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Section and region	All causes				Fire			Disease			Insects			Other [2]		
	Mortality	Salvage [3]	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
North:																
New England	645	11	1,810	2,455	7	20	27	475	1,592	2,067	53	122	175	110	76	186
Middle Atlantic	354	85	2,673	3,027	10	287	297	107	2,138	2,245	24	141	165	213	107	320
Lake States	698	70	4,544	5,242	3	6	9	193	1,794	1,987	20	674	694	482	2,070	2,552
Central	312	104	2,486	2,798	46	446	492	111	1,439	1,550	------	359	359	155	242	397
Plains	70	10	244	314	5	56	61	28	106	134	2	19	21	35	63	98
Total	2,079	280	11,757	13,836	71	815	886	914	7,069	7,983	99	1,315	1,414	995	2,558	3,553
South:																
South Atlantic	267	78	2,319	2,586	47	450	497	68	1,499	1,567	72	330	402	80	40	120
Southeast	841	357	8,236	9,077	154	3,650	3,804	124	3,962	4,086	156	391	547	407	233	640
West Gulf	660	180	3,113	3,773	93	1,408	1,501	41	1,259	1,300	184	328	512	342	118	460
Total	1,768	615	13,668	15,436	294	5,508	5,802	233	6,720	6,953	412	1,049	1,461	829	391	1,220
West:																
Pacific Northwest	4,037	1,988	2,056	6,093	193	182	375	444	987	1,431	1,735	783	2,518	1,665	104	1,769
California	1,865	102	1,177	3,042	131	66	197	204	930	1,134	1,358	94	1,452	172	87	259
Northern Rocky Mountain	1,620	75	1,462	3,082	27	12	39	97	1,199	1,296	1,041	164	1,205	455	87	542
Southern Rocky Mountain	906	29	537	1,443	63	6	69	146	316	462	298	96	394	399	119	518
Total	8,428	2,194	5,232	13,660	414	266	680	891	3,432	4,323	4,432	1,137	5,569	2,691	397	3,088
United States	12,275	3,089	30,657	42,932	779	6,589	7,368	2,038	17,221	19,259	4,943	3,501	8,444	4,515	3,346	7,861
Coastal Alaska	392	(5)	503	895	2	2	4	204	426	630	98	75	173	88	------	88
All regions	12,667	3,089	31,160	43,827	781	6,591	7,372	2,242	17,647	19,889	5,041	3,576	8,617	4,603	3,346	7,949

[1] Mortality estimates represent actual losses in 1952. In all but the Northern Rocky Mountain Region actual mortality was found to agree closely with the current level of mortality indicated by trends over a long period of years, as determined in 1952. In the Northern Rocky Mountain Region, actual mortality of growing stock for 1952 was found to be well above this level for insect losses, at the same level for fire and disease losses and slightly below for losses due to animals, weather, suppression, etc. For sawtimber, actual mortality in the Northern Rocky Mountain Region was well above the current level for insect losses, at the same level for fire losses, and substantially below this level for disease losses and losses due to animals, weather, suppression, etc.

[2] Animals, weather, suppression, etc.

[3] Volume of dead trees utilized in 1952.

[4] Less than 0.5 million cubic feet.

[5] Less than 0.5 million board-feet.

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TABLE 66.—*Mortality from disease in 1952, and estimated growth loss and growth impact of damage to growing by type of disease*

GROWING

Section and region	All diseases			Root diseases		
	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
North:						
New England	218	429	647			
Middle Atlantic	39	511	550			
Lake States	166	508	674			
Central	29	265	294			
Plains	9	25	34			
Total	461	1,738	2,199			
South:						
South Atlantic	20	326	346	3	14	17
Southeast	40	1,102	1,142	5	21	26
West Gulf	13	346	359			
Total	73	1,774	1,847	8	35	43
West:						
Pacific Northwest	78	192	270	44	52	96
California	45	146	191			
Northern Rocky Mountain	36	252	288			
Southern Rocky Mountain	31	70	101			
Total	190	660	850	44	52	96
United States	724	4,172	4,896	52	87	139
Coastal Alaska	49	103	152			
All regions	773	4,275	5,048	52	87	139

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Section and region	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
North:						
New England	475	1,592	2,067			
Middle Atlantic	107	2,138	2,245			
Lake States	193	1,794	1,987			
Central	111	1,439	1,550			
Plains	28	106	134			
Total	914	7,069	7,983			
South:						
South Atlantic	68	1,499	1,567	16	44	60
Southeast	124	3,962	4,086	18	68	86
West Gulf	41	1,259	1,300			
Total	233	6,720	6,953	34	112	146
West:						
Pacific Northwest	444	987	1,431	261	193	454
California	204	930	1,134			
Northern Rocky Mountain	97	1,199	1,296			
Southern Rocky Mountain	146	316	462			
Total	891	3,432	4,323	261	193	454
United States	2,038	17,221	19,259	295	305	600
Coastal Alaska	204	426	630			
All regions	2,242	17,647	19,889	295	305	600

[1] Mortality estimates represent actual losses due to diseases in 1952. They also represent the current level of mortality of growing stock indicated by trends over a long period of years, as determined in 1952. In all but the Northern Rocky Mountain Region actual mortality of sawtimber due to disease was found to agree closely with the current trend level. In the Northern Rocky Mountain Region, however, actual mortality of sawtimber in 1952 was found to be substantially below this level.

[2] Includes many stem rusts, root rots, leaf and needle diseases, Dutch elm disease, phloem necrosis of elm, and persimmon wilt.

stock and livesawtimber during 1952, on commercial forest land in the United States and Coastal Alaska, and section and region [1]

STOCK

Stem diseases			Foliage diseases			Systemic diseases			Other [2]		
Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact
Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
63	349	412				147	57	204	8	23	31
27	466	493				1	12	13	11	33	44
117	484	601				11		11	38	24	62
	241	241				2		2	27	24	51
3	25	28							6		6
210	1,565	1,775				161	69	230	90	104	194
8	274	282			3	1	2	3	8	33	41
18	995	1,013			9	5	18	23	12	59	71
1	288	289		4	4	6	15	21	6	39	45
27	1,557	1,584		16	16	12	35	47	26	131	157
15	111	126							19	29	48
	82	82							45	64	109
14	235	249	8	1	9	11	3	14	3	13	16
13	56	69							18	14	32
42	484	526	8	1	9	11	3	14	85	120	205
279	3,606	3,885	8	17	25	184	107	291	201	355	556
4	58	62							45	45	90
283	3,664	3,947	8	17	25	184	107	291	246	400	646

TIMBER

Million bd.-ft.	*Million bd.-ft*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
171	1,370	1,541				287	173	460	17	49	66
81	2,035	2,116				3	32	35	23	71	94
88	1,732	1,820				31	8	39	74	54	128
1	1,355	1,356				7	1	8	103	83	186
7	103	110							21	3	24
348	6,595	6,943				328	214	542	238	260	498
25	1,321	1,346		11	11	1	7	8	26	116	142
55	3,641	3,696		36	36	4	13	17	47	204	251
4	1,075	1,079		12	12	4	12	16	33	160	193
84	6,037	6,121		59	59	9	32	41	106	480	586
86	653	739							97	141	238
	607	607							204	323	527
10	1,112	1,122	40	6	46	27	34	61	20	47	67
60	251	311							86	65	151
156	2,623	2,779	40	6	46	27	34	61	407	576	983
588	15,255	15,843	40	65	105	364	280	644	751	1,316	2,067
22	310	332							182	116	298
610	15,565	16,175	40	65	105	364	280	644	933	1,432	2,365

TABLE 67.—*Mortality from insects in 1952, and estimated growth loss and growth impact of damage to growing stock and live sawtimber during 1952, on commercial forest land in the United States and Coastal Alaska, by groups of insects and section and region* [1]

Section and region	All insects			Bark beetles			Defoliators			Other [2]		
	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact
GROWING STOCK												
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
North:												
New England	23	43	66	5		5	11	9	20	7	34	41
Middle Atlantic	8	59	67	1		1		31	31	7	28	35
Lake States	34	136	170				1	129	130	33	7	40
Central		92	92					8	8		84	84
Plains		3	3					2	2		1	1
Total	65	333	398	6		6	12	179	191	47	154	201
South:												
South Atlantic	23	95	118	19		19		10	10	4	85	89
Southeast	42	97	139	34	5	39		11	11	9	81	90
West Gulf	47	59	106	33	10	43	3	9	12	10	40	50
Total	112	251	363	86	15	101	3	30	33	23	206	229
West:												
Pacific Northwest	314	122	436	312	101	413	1	21	22	1		1
California	228	16	244	187	14	201				41	2	43
Northern Rocky Mountain	188	22	210	188		188		22	22			
Southern Rocky Mountain	66	20	86	62	1	63	3	19	22	1		1
Total	796	180	976	749	116	865	4	62	66	43	2	45
United States	973	764	1, 737	841	131	972	19	271	290	113	362	475
Coastal Alaska	27	14	41					12	12	27	2	29
All regions	1, 000	778	1, 778	841	131	972	19	283	302	140	364	504
SAWTIMBER												
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
North:												
New England	53	122	175	26		26	6	7	13	21	115	136
Middle Atlantic	24	141	165	2		2	1	61	62	21	80	101
Lake States	20	674	694				2	647	649	18	27	45
Central		359	359					37	37		322	322
Plains	2	19	21	1	1	2		9	9	1	9	10
Total	99	1, 315	1, 414	29	1	30	9	761	770	61	553	614
South:												
South Atlantic	72	330	402	63		63		38	38	9	292	301
Southeast	156	391	547	134	25	159		39	39	22	327	349
West Gulf	184	328	512	137	76	213	2	40	42	45	212	257
Total	412	1, 049	1, 461	334	101	435	2	117	119	76	831	907
West:												
Pacific Northwest	1, 735	783	2, 518	1, 724	657	2, 381	5	125	130	6	1	7
California	1, 358	94	1, 452	1, 117	79	1, 196				241	15	256
Northern Rocky Mountain	1, 041	164	1, 205	1, 041	31	1, 072		133	133			
Southern Rocky Mountain	298	96	394	282	19	301	15	76	91	1	1	2
Total	4, 432	1, 137	5, 569	4, 164	786	4, 950	20	334	354	248	17	265
United States	4, 943	3, 501	8, 444	4, 527	888	5, 415	31	1, 212	1, 243	385	1, 401	1, 786
Coastal Alaska	98	75	173					62	62	98	13	111
All regions	5, 041	3, 576	8, 617	4, 527	888	5, 415	31	1, 274	1, 305	483	1, 414	1, 897

[1] Mortality estimates represent actual losses due to insects in 1952. In all but the Northern Rocky Mountain Region actual mortality was found to agree closely with the current level of mortality indicated by trends over a long period of years, as determined in 1952. In the Northern Rocky Mountain Region actual mortality of both growing stock and sawtimber in 1952 was found to be well above this level.

[2] Includes hardwood borers, white pine weevil, pine tip moths, turpentine borer, cone and seed insects, Saratoga spittlebug, and the balsam woolly aphid.

TABLE 68.—*Mortality from weather, animals, and miscellaneous causes in 1952, and estimated growth loss and growth impact of damage to growing stock and live sawtimber during 1952, on commercial forest land in the United States and Coastal Alaska, by section and region* [1]

GROWING STOCK

Section and region	All miscellaneous			Weather			Animals			Other [2]		
	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
North:												
New England	53	40	93	28	11	39	9	12	21	16	17	33
Middle Atlantic	178	75	253	90	17	107	18	15	33	70	43	113
Lake States	283	709	992	92	-	92	9	709	718	182	-	182
Central	52	72	124	-	-	-	-	72	72	52	-	52
Plains	18	35	53	6	1	7	3	22	25	9	12	21
Total	584	931	1,515	216	29	245	39	830	869	329	72	401
South:												
South Atlantic	36	7	43	12	3	15	1	2	3	23	2	25
Southeast	161	49	210	65	16	81	-	18	18	96	15	111
West Gulf	121	37	158	41	12	53	-	18	18	80	7	87
Total	318	93	411	118	31	149	1	38	39	199	24	223
West:												
Pacific Northwest	321	67	388	308	6	314	13	61	74	-	-	-
California	65	34	99	-	-	-	-	-	-	65	34	99
Northern Rocky Mountain	98	17	115	98	7	105	-	4	4	-	6	6
Southern Rocky Mountain	92	52	144	80	41	121	12	11	23	-	-	-
Total	576	170	746	486	54	540	25	76	101	65	40	105
United States	1,478	1,194	2,672	820	114	934	65	944	1,009	593	136	729
Coastal Alaska	23	-	23	23	-	23	-	-	-	-	-	-
All regions	1,501	1,194	2,695	843	114	957	65	944	1,009	593	136	729

SAWTIMBER

Section and region	All miscellaneous			Weather			Animals			Other [2]		
	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact	Mortality	Growth loss	Growth impact
	Million bd.-ft.	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
North:												
New England	110	76	186	60	25	85	16	23	39	34	28	62
Middle Atlantic	213	107	320	108	37	145	19	27	46	86	43	129
Lake States	482	2,070	2,552	310	-	310	42	2,070	2,112	130	-	130
Central	155	242	397	-	-	-	-	242	242	155	-	155
Plains	35	63	98	21	36	57	2	10	12	12	17	29
Total	995	2,558	3,553	499	98	597	79	2,372	2,451	417	88	505
South:												
South Atlantic	80	40	120	40	24	64	1	2	3	39	14	53
Southeast	407	233	640	206	81	287	-	79	79	201	73	274
West Gulf	342	118	460	150	74	224	-	5	5	192	39	231
Total	829	391	1,220	396	179	575	1	86	87	432	126	558
West:												
Pacific Northwest	1,665	104	1,769	1,613	79	1,692	52	25	77	-	-	-
California	172	87	259	-	-	-	-	-	-	172	87	259
Northern Rocky Mountain	455	87	542	450	35	485	-	21	21	5	31	36
Southern Rocky Mountain	399	119	518	341	91	432	58	28	86	-	-	-
Total	2,691	397	3,088	2,404	205	2,609	110	74	184	177	118	295
United States	4,515	3,346	7,861	3,299	482	3,781	190	2,532	2,722	1,026	332	1,358
Coastal Alaska	88	-	88	88	-	88	-	-	-	-	-	-
All regions	4,603	3,346	7,949	3,387	482	3,869	190	2,532	2,722	1,026	332	1,358

[1] Mortality estimates represent actual losses due to animals, weather, suppression, etc., in 1952. In all but the Northern Rocky Mountain Region actual mortality was found to agree closely with the current level of mortality indicated by trends over a long period of years, as determined in 1952. In the Northern Rocky Mountain Region actual mortality of both growing stock and sawtimber in 1952 was found to be below this level.

[2] Principally suppression.

TABLE 69.—*Growth impact of damage by fire to growing stock during 1952 on commercial forest land in the United States and Coastal Alaska, by ownership class and section and region*

Section and region	All ownerships	Federal ownership or trusteeship					State, county, and municipal	Private
		Total	National forest	Indian	Bureau of Land Management	Other		
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
North:								
New England	6.7						(1)	6.7
Middle Atlantic	46.5	0.4	0.4				0.3	45.8
Lake States	3.9	.5	.4	0.1		(1)	.5	2.9
Central	121.8	3.2	2.2			1.0	.3	118.3
Plains	14.2	.6		.3		.3	.2	13.4
Total	193.1	4.7	3.0	.4		1.3	1.3	187.1
South:								
South Atlantic	104.2	7.5	4.3	.9		2.3	1.5	95.2
Southeast	923.0	11.9	4.9	2.5	0.6	3.9	22.6	888.5
West Gulf	350.2	9.1	1.7	.4	1.0	6.0	3.3	337.8
Total	1,377.4	28.5	10.9	3.8	1.6	12.2	27.4	1,321.5
West:								
Pacific Northwest	61.4	15.8	13.5		2.3		3.7	41.9
California	32.0	16.3	15.4	.4	.5		.4	15.3
Northern Rocky Mountain	10.0	4.4	3.7	.2	.5		.2	5.4
Southern Rocky Mountain	11.7	9.9	9.8		.1		.7	1.1
Total	115.1	46.4	42.4	.6	3.4		5.0	63.7
United States	1,685.6	79.6	56.3	4.8	5.0	13.5	33.7	1,572.3
Coastal Alaska	2.0	2.0	2.0					
All regions	1,687.6	81.6	58.3	4.8	5.0	13.5	33.7	1,572.3

1 Less than 0.05 million cubic feet.

TABLE 70.—*Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by public and private ownership and section and region, 1953* [1]

Section and region	All ownerships				All public				All private			
	Operating area	Productivity			Operating area	Productivity			Operating area	Productivity		
		Upper	Medium	Lower		Upper	Medium	Lower		Upper	Medium	Lower
	Thousand acres	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*
North:												
New England	15, 040	63	29	8	1, 356	95	2	3	13, 684	60	32	8
Middle Atlantic	14, 279	66	23	11	3, 191	93	6	1	11, 088	58	28	14
Lake States	23, 939	77	20	3	16, 001	80	19	1	7, 938	69	23	8
Central	11, 140	54	35	11	2, 379	89	11	(2)	8, 761	45	41	14
Plains	93	13	36	51	29	28	55	17	64	6	28	66
Total	64, 491	67	26	7	22, 956	83	16	1	41, 535	58	31	11
South:												
South Atlantic	17, 964	64	26	10	3, 316	91	7	2	14, 648	58	30	12
Southeast	46, 944	57	23	20	5, 473	90	8	2	41, 471	53	25	22
West Gulf	22, 509	46	34	20	2, 942	73	24	3	19, 567	42	36	22
Total	87, 417	55	27	18	11, 731	86	12	2	75, 686	51	29	20
West:												
Pacific Northwest:												
Douglas-fir subregion	17, 940	83	13	4	8, 667	87	11	2	9, 273	79	15	6
Pine subregion	13, 222	79	18	3	9, 898	85	14	1	3, 324	62	32	6
Total	31, 162	81	15	4	18, 565	86	12	2	12, 597	75	19	6
California	9, 065	77	22	1	5, 343	74	26	---	3, 722	81	17	2
Northern Rocky Mountain	24, 828	62	27	11	20, 856	66	24	10	3, 972	39	48	13
Southern Rocky Mountain	13, 690	78	19	3	12, 082	80	18	2	1, 608	59	30	11
Total	78, 745	74	21	5	56, 846	76	19	5	21, 899	68	25	7
United States	230, 653	65	24	11	91, 533	79	17	4	[3] 139, 120	56	29	15
Coastal Alaska	4, 224	89	11	---	4, 224	89	11	---	---	---	---	---
All regions	[3] 234, 877	65	24	11	95, 757	80	17	3	139, 120	56	29	15

[1] The determination of size class of private ownership was based on the total commercial forest land area in the ownership. The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Productivity is expressed as a percentage of operating area found to be in a high, medium, or low productivity class.

[2] Less than 0.5 percent.

[3] Excludes 1,537 thousand acres of commercial forest land in large private ownerships on which access was denied. The proportion of this area in operating status is not known.

TABLE 71.—*Productivity of recently cut commercial forest land in public ownership in the*

Section and region	National forest				Bureau of Land Management			
	Operating area	Productivity			Operating area	Productivity		
		Upper	Medium	Lower		Upper	Medium	Lower
	Thousand acres	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*
North:								
New England	806	97	3					
Middle Atlantic	1,177	98	2					
Lake States	5,082	77	22	1	45		100	
Central	1,829	89	11					
Plains	8	100						
Total or average	8,902	84	16	(2)	45		100	
South:								
South Atlantic	2,544	94	6					
Southeast	3,407	95	3	2				
West Gulf	2,603	76	24		13	100		
Total or average	8,554	89	10	1	13	100		
West:								
Pacific Northwest:								
Douglas-fir subregion	4,380	92	8		2,020	86	14	
Pine subregion	6,980	89	10	1	285	75	25	
Total or average	11,360	90	10	(2)	2,305	85	15	
California	5,093	75	25		118	30	70	
Northern Rocky Mountain	18,312	68	22	10	673	68	24	8
Southern Rocky Mountain	9,973	85	15	(2)	670	64	7	29
Total or average	44,738	79	17	4	3,766	76	17	7
United States	62,194	81	16	3	3,824	76	18	6
Coastal Alaska	3,443	87	13		781	100		
All regions	65,637	81	16	3	4,605	80	15	5

[1] The determination of size class of private ownership was based on the total commercial forest land area in the ownership. The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Productivity is expressed as a percentage of operating area found to be in a high, medium, or low productivity class.

[2] Less than 0.5 percent.

United States and Coastal Alaska, by type of ownership and section and region, 1953 [1]

Indian				Other Federal				State, county, and municipal			
Operating area	Productivity			Operating area	Productivity			Operating area	Productivity		
	Upper	Medium	Lower		Upper	Medium	Lower		Upper	Medium	Lower
Thousand acres	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*
-	-	-	-	11	9	-	91	539	93	1	6
-	-	-	-	62	39	61	-	1,952	92	7	1
803	96	3	1	106	59	11	30	9,965	81	19	(2)
-	-	-	-	137	64	36	-	413	94	6	(2)
16	-	69	31	-	-	-	-	5	-	100	-
819	94	4	2	316	56	31	13	12,874	83	16	1
45	100	-	-	410	73	15	12	317	92	7	1
-	-	-	-	1,307	90	10	-	759	70	29	1
-	-	-	-	207	59	37	4	119	12	28	60
45	100	-	-	1,924	83	14	3	1,195	70	23	7
195	82	17	1	52	100	-	-	2,020	78	13	9
2,140	83	17	-	30	43	57	-	463	39	45	16
2,335	83	17	(2)	82	79	21	-	2,483	70	19	11
73	100	-	-	-	-	-	-	59	100	-	-
501	52	42	6	-	-	-	-	1,370	36	47	17
1,242	53	47	-	43	95	5	-	154	49	18	33
4,151	70	29	1	125	85	15	-	4,066	58	28	14
5,015	74	25	1	2,365	80	16	4	18,135	77	19	4
-	-	-	-	-	-	-	-	-	-	-	-
5,015	74	25	1	2,365	80	16	4	18,135	77	19	4

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TABLE 72.—*Productivity of recently cut commercial forest land in private ownership in*

Section and region	Small private holdings							
	Under 100 acres [2]				100 to 500 acres			
	Operating area	Productivity			Operating area	Productivity		
		Upper	Medium	Lower		Upper	Medium	Lower
	Thousand acres	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*
North:								
New England	1,355	36	42	22	2,006	40	38	22
Middle Atlantic	3,147	59	32	9	2,343	58	32	10
Lake States	2,150	57	28	15	1,988	60	33	7
Central	3,421	42	43	15	3,004	50	38	12
Plains	64	6	28	66	--	--	--	--
Total or average	10,137	50	36	14	9,341	52	35	13
South:								
South Atlantic	3,688	41	41	18	4,650	45	36	19
Southeast	6,049	25	32	43	10,352	37	29	34
West Gulf	3,495	19	47	34	4,575	21	46	33
Total or average	13,232	27	39	34	19,577	35	35	30
West:								
Pacific Northwest:								
Douglas-fir subregion	588	59	34	7	1,288	57	27	16
Pine subregion	55	25	44	31	543	18	63	19
Total or average	643	56	34	10	1,831	46	38	16
California	40	55	20	25	198	40	43	17
Northern Rocky Mountain	68	21	51	28	615	12	59	29
Southern Rocky Mountain	10	20	70	10	151	35	58	7
Total or average	761	52	36	12	2,795	37	44	19
Continental United States	24,130	38	37	25	31,713	40	36	24

[1] The determination of size class of private ownership was based on the total commercial forest land area in the ownership. The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Productivity is expressed as a percentage of operating area found to be in a high, medium, or low productivity class.

TABLE 73.—*Productivity of recently cut commercial forest land in private ownership*

Section and region	Farm				Lumber manufacturer [2]			
	Operating area	Productivity			Operating area	Productivity		
		Upper	Medium	Lower		Upper	Medium	Lower
	Thousand acres	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*
North:								
New England	2,173	42	39	19	538	--	--	--
Middle Atlantic	4,235	62	29	9	713	--	--	--
Lake States	3,341	59	29	12	815	--	--	--
Central	5,828	45	42	13	297	--	--	--
Plains	64	6	28	66	--	--	--	--
Total or average	15,641	52	35	13	2,363	68	24	8
South:								
South Atlantic	7,958	45	38	17	1,871	--	--	--
Southeast	18.824	35	34	31	4,213	--	--	--
West Gulf	5,784	18	51	31	5,665	--	--	--
Total or average	32,566	34	38	28	11,749	69	23	8
West:								
Pacific Northwest:								
Douglas-fir subregion	1,480	53	34	13	4,434	--	--	--
Pine subregion	1,320	38	52	10	1,493	--	--	--
Total or average	2,800	46	42	12	5,927	--	--	--
California	543	61	33	6	2,093	--	--	--
Northern Rocky Mountain	485	15	61	24	1,791	--	--	--
Southern Rocky Mountain	943	56	33	11	135	--	--	--
Total or average	4,771	46	42	12	9,946	78	19	3
All regions	52,978	41	37	22	24,058	73	21	6

[1] The determination of size class of private ownership was based on the total commercial forest land area in the ownership. The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Productivity is expressed as a percentage of operating area found to be in a high, medium, or low productivity class.

continental United States, by size class of ownership and section and region, 1953 [1]

Small private holdings—Continued				Medium private holdings (5,000 to 50,000 acres)				Large private holdings (50,000 and larger)			
500 to 5,000 acres											
Operating area	Productivity			Operating area	Productivity			Operating area	Productivity		
	Upper	Medium	Lower		Upper	Medium	Lower		Upper	Medium	Lower
Thousand acres	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*
479	22	40	38	1, 766	70	23	7	8, 078	69	30	1
1, 525	50	10	40	2, 227	55	32	13	1, 846	65	28	7
516	72	5	23	804	70	24	6	2, 480	87	13	(3)
1, 182	38	36	26	829	46	49	5	325	37	50	13
----	----	----	----	----	----	----	----	----	----	----	----
3, 702	46	21	33	5, 626	61	30	9	12, 729	71	27	2
1, 538	44	50	6	2, 056	84	15	1	2, 716	89	7	4
7, 792	41	38	21	7, 412	63	24	13	9, 866	86	8	6
1, 479	21	37	42	3, 266	48	37	15	6, 752	70	21	9
10, 809	39	40	21	12, 734	63	26	11	19, 334	81	13	6
1, 273	63	27	10	1, 775	75	16	9	4, 349	94	4	2
969	46	45	9	442	64	36	----	1, 315	94	6	----
2, 242	56	35	9	2, 217	73	20	7	5, 664	94	5	1
554	64	29	7	1, 433	87	13	----	1, 497	87	13	----
645	41	48	11	296	49	33	18	2, 348	45	46	9
379	56	35	9	293	34	23	43	775	76	24	----
3, 820	55	36	9	4, 239	73	19	8	10, 284	80	17	3
18, 331	44	35	21	22, 599	64	26	10	[4] 42, 347	78	18	4

[2] Includes ownerships containing 3 to 100 acres of commercial forest land in the East and 10 to 100 acres in the West.
[3] Less than 0.5 percent.
[4] Excludes 1,537 thousand acres of commercial forest land in large private ownerships on which access was denied. The proportion of this area in operating status is not known.

in continental United States, by type of ownership and section and region, 1953 [1]

Pulp manufacturer				All forest industries [3]				Other private			
Operating area	Productivity			Operating area	Productivity			Operating area	Productivity		
	Upper	Medium	Lower		Upper	Medium	Lower		Upper	Medium	Lower
Thousand acres	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*
5, 322	56	43	1	6, 037	54	41	5	5, 474	74	19	7
755	100	----	----	1, 549	86	13	1	5, 304	47	32	21
920	92	2	(4)	1, 802	93	7	(4)	2, 795	66	25	9
----	----	----	----	537	46	54	(4)	2, 396	44	34	22
----	----	----	----	----	----	----	----	----	----	----	----
6, 997	66	33	1	9, 925	66	31	3	15, 969	59	27	14
1, 895	98	----	2	4, 023	81	15	4	2, 667	60	32	8
5, 392	99	1	----	11, 207	88	9	3	11, 440	46	28	26
1, 633	82	18	(4)	7, 593	69	24	7	6, 190	32	34	34
8, 920	96	4	(4)	22, 823	81	15	4	20, 297	44	30	26
1, 371	95	(4)	5	6, 029	89	7	4	1, 764	67	23	10
60	80	20	----	1, 553	88	12	----	451	44	40	16
1, 431	94	1	5	7, 582	89	8	3	2, 215	62	27	11
54	100	----	----	2, 243	87	12	1	936	79	19	2
----	----	----	----	1, 865	33	57	10	1, 622	53	34	13
----	----	----	----	135	79	18	3	530	61	27	12
1, 485	94	1	5	11, 825	80	16	4	5, 303	62	27	11
17, 402	84	15	1	[5] 44, 573	77	19	4	41, 569	52	28	20

[2] Productivity ratings are omitted on a regional basis because sampling of small ownerships, which make up a large share of the total, was not adequate to provide valid estimates for region breakdowns.
[3] Includes lumber, pulp, and all other wood-using industries combined.
[4] Less than 0.5 percent.
[5] Excludes 1,537 thousand acres of commercial forest land in large private ownerships on which access was denied. The proportion of this area in operating status is not known.

TABLE 74.—*Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by stand-size class, section, region, and ownership class, 1953* [1]

NORTH

Region and ownership class [2]	Sawtimber				Poletimber				Seedlings and saplings			
	Operating area	Productivity			Operating area	Productivity			Operating area	Productivity		
		Upper	Medium	Lower		Upper	Medium	Lower		Upper	Medium	Lower
	Thousand acres	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*
New England:												
Small private	216	90	4	6	1,498	39	39	22	2,126	27	47	26
Medium and large private	374	100	--	--	4,354	98	2	(3)	5,116	34	64	2
National forest	641	100	--	--	122	100	--	--	43	100	--	--
Other public	28	100	--	--	352	78	22	--	170	69	--	31
Total or average	1,259	98	1	1	6,326	81	13	6	7,455	31	58	11
Middle Atlantic:												
Small private	819	75	24	1	3,506	71	23	6	2,690	33	33	34
Medium and large private	247	79	21	--	1,833	65	26	9	1,993	53	34	13
National forest	1,112	100	--	--	65	100	--	--	--	--	--	--
Other public	259	42	58	--	1,037	100	--	--	718	90	1	9
Total or average	2,437	82	18	(3)	6,441	75	19	6	5,401	49	28	23
Lake States:												
Small private	982	74	20	6	1,606	59	32	9	2,066	50	29	21
Medium and large private [4]	1,037	100	--	--	676	83	17	--	1,571	66	33	1
National forest	426	100	--	--	2,060	88	12	--	2,596	72	28	--
Other public	329	100	--	--	3,706	96	4	--	6,884	84	16	(3)
Total or average	2,774	90	8	2	8,048	85	13	2	13,117	73	23	4
Central:												
Small private	2,134	66	31	3	4,321	40	43	17	1,152	26	43	31
Medium and large private	248	81	19	--	670	28	64	8	236	47	47	6
National forest	756	78	22	--	1.073	99	1	--	--	--	--	--
Other public	315	93	7	--	165	98	2	--	70	25	71	4
Total or average	3,453	72	26	2	6,229	51	36	13	1,458	29	45	26
Plains:												
Small private	23	12	53	35	--	--	--	--	41	--	--	100
Medium and large private	--	--	--	--	--	--	--	--	--	--	--	--
National forest	--	--	--	--	8	100	--	--	--	--	--	--
Other public	--	--	--	--	6	--	100	--	15	--	75	25
Total or average	23	12	53	35	14	79	21	--	56	--	19	81
Total, North:												
Small private	4,174	71	25	4	10,931	52	35	13	8,075	35	37	28
Medium and large private [4]	1,906	95	5	--	7,533	83	14	3	8,916	44	52	4
National forest	2,935	94	6	--	3,328	92	8	--	2,639	72	28	--
Other public	931	82	18	--	5,266	96	4	--	7,857	84	15	1
Total or average	9,946	83	15	2	27,058	74	20	6	27,487	55	35	10
SOUTH												
South Atlantic:												
Small private	967	57	35	8	3,606	48	35	17	5,303	45	37	18
Medium and large private [4]	574	100	--	--	1,560	73	27	--	2,638	94	6	--
National forest	513	100	--	--	1,842	100	--	--	189	100	--	--
Other public	148	100	--	--	261	96	4	--	363	57	42	1
Total or average	2,202	80	16	4	7,269	67	24	9	8,493	61	28	11
Southeast:												
Small private	784	72	15	13	8,804	38	30	32	14,605	27	33	40
Medium and large private [4]	1,959	93	6	1	8,164	68	24	8	7,155	81	10	9
National forest	720	100	--	--	2,217	100	--	--	470	68	32	--
Other public	702	96	4	--	810	94	6	--	554	69	31	--
Total or average	4,165	90	7	3	19,995	59	23	18	22,784	46	26	28
West Gulf:												
Small private	696	22	69	9	2,716	30	36	34	6,137	15	41	44
Medium and large private [4]	5,430	86	12	2	2,522	47	27	26	2,066	48	37	15
National forest	2,076	93	7	--	400	100	--	--	127	100	--	--
Other public	82	54	46	--	45	--	21	79	212	41	30	29
Total or average	8,284	82	16	2	5,683	42	29	29	8,542	26	39	35
Total, South:												
Small private	2,447	51	39	10	15,126	38	33	29	26,045	28	36	36
Medium and large private [4]	7,963	88	10	2	12,246	63	25	12	11,859	77	15	8
National forest	3,309	95	5	--	4,459	100	--	--	786	81	19	--
Other public	932	91	9	--	1,116	88	7	5	1,129	58	34	8
Total or average	14,651	84	13	3	32,947	57	25	18	39,819	44	29	27

See footnotes at end of table.

TABLE 74.—*Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by stand-size class, section, region, and ownership class, 1953* [1]—Continued

WEST

Region and ownership class [2]	Sawtimber				Poletimber				Seedlings and saplings			
	Operating area	Productivity			Operating area	Productivity			Operating area	Productivity		
		Upper	Medium	Lower		Upper	Medium	Lower		Upper	Medium	Lower
	Thousand acres	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*
Pacific Northwest:												
Douglas-fir subregion:												
Small private	124	48	30	22	275	58	38	4	2,750	62	27	11
Medium and large private	305	100			13	93	7		5,806	89	7	4
National forest	376	100							4,004	93	7	
Other public	30	88	12		27	46		54	4,230	85	15	(3)
Total or average	835	93	4	3	315	58	34	8	16,790	85	12	3
Pine subregion:												
Small private	529	47	32	21	365	50	39	11	673	29	61	10
Medium and large private	880	89	11		148	67	33		729	75	25	
National forest	6,087	92	7	1					893	77	23	
Other public	2,155	90	10		154	28	71	1	609	70	20	10
Total or average	9,651	89	9	2	667	49	45	6	2,904	65	31	4
Total, Pacific Northwest:												
Small private	653	47	32	21	640	54	38	8	3,423	55	34	11
Medium and large private	1,185	92	8		161	69	31		6,535	88	9	3
National forest	6,463	93	6	1					4,897	90	10	
Other public	2,185	90	10		181	30	62	8	4,839	83	15	2
Total or average	10,486	90	9	1	982	52	42	6	19,694	82	15	3
California:												
Small private	178	60	25	15	200	31	48	21	414	69	27	4
Medium and large private [4]	1,088	85	15		208	73	27		1,634	89	11	
National forest	4,112	74	26		103	45	55		878	95	5	
Other public	103	45	55						147	83	17	
Total or average	5,481	75	25	(3)	511	51	42	7	3,073	88	11	1
Northern Rocky Mountain:												
Small private	586	16	72	12	549	29	56	15	193	31	36	33
Medium and large private	1,924	57	40	3	495	4	96		225		7	93
National forest	15,290	70	23	7	469	100			2,553	63	(3)	37
Other public	1,854	57	40	3	596	26	42	32	94	77		23
Total or average	19,654	66	28	6	2,109	38	48	14	3,065	57	3	40
Southern Rocky Mountain:												
Small private	94	8	83	9	189	54	39	7	257	59	33	8
Medium and large private	284	56	33	11	684	84	6	10	100	25	75	
National forest	6,174	83	17	(3)	1,459	79	21		2,340	85	15	
Other public	1,121	54	45	1	275	72	14	14	713	76		24
Total or average	7,673	77	22	1	2,607	78	17	5	3,410	80	15	5
Total, West:												
Small private	1,511	34	49	17	1,578	42	46	12	4,287	55	34	11
Medium and large private [4]	4,481	73	25	2	1,548	56	39	5	8,494	85	10	5
National forest	32,039	78	19	3	2,031	82	18		10,668	83	9	8
Other public	5,263	70	29	1	1,052	39	38	23	5,793	82	13	5
Total or average	43,294	75	22	3	6,209	59	33	8	29,242	80	13	7
ALL REGIONS												
Continental United States:												
Small private	8,132	58	34	8	27,635	44	34	22	38,407	32	36	32
Medium and large private [4]	14,350	85	13	2	21,327	70	22	8	29,269	69	25	6
National forest	38,283	81	16	3	9,818	93	7		14,093	81	13	6
Other public	7,126	74	25	1	7,434	87	9	4	14,779	81	16	3
Total or average	67,891	78	19	3	66,214	64	24	12	96,548	57	26	17
Coastal Alaska: [5]												
National forest									3,443	87	13	
Other public									781	100		
Total or average									4,224	89	11	
Total, all regions:												
Small private	8,132	58	34	8	27,635	44	34	22	38,407	32	36	32
Medium and large private [4]	14,350	85	13	2	21,327	70	22	8	29,269	69	25	6
National forest	38,283	81	16	3	9,818	93	7		17,536	82	13	5
Other public	7,126	74	25	1	7,434	87	9	4	15,560	81	15	4
Total or average	67,891	78	19	3	66,214	64	24	12	100,772	58	26	16

[1] The determination of size class of private ownership was based on the total commercial forest land area in the ownership. The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Productivity is expressed as a percentage of operating area found to be in a high, medium, or low productivity class.

[2] Small private includes ownerships containing 3 to 5,000 acres of commercial forest land in the East and 10 to 5,000 acres in the West. Medium and large private includes ownerships of 5,000 acres and larger.

[3] Less than 0.5 percent.

[4] Excludes operating area on some large private ownerships on which access was denied.

[5] Certain classes of private ownership were omitted in this region because there were no ownerships of the omitted classes or they were so small that total operating area by stand-size class could not be adequately determined by sampling procedures.

TABLE 75.—*Productivity of recently cut privately owned commercial forest land in*

Section and type of ownership	All classes				Small private holdings: Under 100 acres [2]			
	Operating area	Productivity: Upper	Productivity: Medium	Productivity: Lower	Operating area	Productivity: Upper	Productivity: Medium	Productivity: Lower
	Thousand acres	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*
North:								
Farm	15, 641	52	35	13	7, 670	50	38	12
Lumber manufacturer	2, 363	68	24	8	90	59	31	10
Pulp manufacturer	6, 997	66	33	1	—	—	—	—
Other wood manufacturer	565	53	38	9	—	—	—	—
Other private	15, 969	59	27	14	2, 377	48	31	21
Total or average	41, 535	58	31	11	10, 137	50	36	14
South:								
Farm	32, 566	34	38	28	10, 368	26	40	34
Lumber manufacturer	11, 749	69	23	8	51	30	35	35
Pulp manufacturer	8, 920	96	4	(3)	—	—	—	—
Other wood manufacturer	2, 154	78	22	(3)	—	—	—	—
Other private	20, 297	44	30	26	2, 813	34	31	35
Total or average	75, 686	51	29	20	13, 232	27	39	34
West:								
Farm	4, 771	46	42	12	473	54	38	8
Lumber manufacturer	9, 946	78	19	3	10	30	—	70
Pulp manufacturer	1, 485	94	1	5	—	—	—	—
Other wood manufacturer	394	73	9	18	—	—	—	—
Other private	5, 303	62	27	11	278	51	33	16
Total or average	21, 899	68	25	7	761	52	36	12
Continental United States:								
Farm	52, 978	41	37	22	18, 511	37	39	24
Lumber manufacturer	24, 058	73	21	6	151	47	30	23
Pulp manufacturer	17, 402	84	15	1	—	—	—	—
Other wood manufacturer	3, 113	73	23	4	—	—	—	—
Other private	41, 569	52	28	20	5, 468	41	31	28
Total or average [4]	139, 120	56	29	15	24, 130	38	37	25

[1] The determination of size class of private ownership was based on the total commercial forest land area in the ownership. The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Productivity is expressed as a percentage of operating area found to be in a high, medium or low productivity class.

continental United States, by type of ownership, size class, and section, 1953 [1]

Small private holdings—Continued								Medium private holdings (5,000 to 50,000 acres)				Large private holdings (50,000 acres and larger)			
100 to 500 acres				500 to 5,000 acres											
Operating area	Productivity			Operating area	Productivity			Operating area	Productivity			Operating area	Productivity		
	Upper	Medium	Lower		Upper	Medium	Lower		Upper	Medium	Lower		Upper	Medium	Lower
Thousand acres	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*
6, 717	55	35	10	1, 170	41	25	34	84	100	—	—	—	—	—	—
242	41	34	25	578	60	23	17	800	64	32	4	653	90	10	—
—	—	—	—	—	—	—	—	604	81	17	2	6, 393	65	34	1
1	—	100	—	9	100	—	—	265	56	25	19	290	48	52	—
2, 381	45	36	19	1, 945	44	19	37	3, 873	56	34	10	5, 393	78	19	3
9, 341	52	35	13	3, 702	46	21	33	5, 626	61	30	9	12, 729	71	27	2
13, 995	36	34	30	6, 604	40	43	17	1, 599	52	30	18	—	—	—	—
617	25	58	17	469	59	20	21	4, 263	70	22	8	6, 349	75	20	5
—	—	—	—	85	24	76	—	172	100	—	—	8, 663	96	3	1
37	—	100	—	34	100	—	—	1, 574	72	27	1	509	100	—	—
4, 928	35	33	32	3, 617	34	35	31	5, 126	56	28	16	3, 813	54	23	23
19, 577	35	35	30	10, 809	39	40	21	12, 734	63,	26	11	19, 334	81	13	6
1, 411	29	54	17	2, 071	48	41	11	471	56	30	14	345	84	16	—
107	32	50	18	783	56	33	11	2, 588	82	13	5	6, 458	79	20	1
—	—	—	—	6	—	50	50	190	58	6	36	1, 289	100	—	—
2	100	—	—	35	80	20	—	283	91	9	—	74	—	7	93
1, 275	48	32	20	925	67	38	5	707	48	41	11	2, 118	75	19	6
2, 795	37	44	19	3, 820	55	36	9	4, 239	73	19	8	10, 284	80	17	3
22, 123	41	36	23	9, 845	42	40	18	2, 154	55	29	16	345	84	16	—
966	30	51	19	1, 830	58	27	15	7, 651	74	20	6	13, 460	78	19	3
—	—	—	—	91	22	75	3	966	79	12	9	16, 345	84	15	1
40	5	95	—	78	91	9	—	2, 122	73	24	3	873	74	18	8
8, 584	40	33	27	6, 487	42	29	29	9, 706	56	31	13	11, 324	69	21	10
31, 713	40	36	24	18, 331	44	35	21	22, 599	64	26	10	42, 347	78	18	4

[2] Includes ownerships containing 3 to 100 acres of commercial forest land in the East and 10 to 100 acres in the West.
[3] Less than 0.5 percent.

[4] Excludes 1,537 thousand acres of commercial forest land in large private ownerships on which access was denied. The proportion of this in operating status is not known.

TABLE 76.—*Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by size class of primary forest products harvested, and section, region, and ownership class, 1953* [1]

Region and ownership class [2]	Large products [3]				Both large and small products [4]				Small products [5]			
	Operating area	Productivity			Operating area	Productivity			Operating area	Productivity		
		Upper	Medium	Lower		Upper	Medium	Lower		Upper	Medium	Lower
	Thousand acres	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*
NORTH												
New England:												
Small private	1,941	35	34	31	695	28	61	11	1,204	41	42	17
Medium and large private	1,141	74	17	9	1,170	82	16	2	7,533	60	40	(6)
National forest	723	100			33	100			50	100		
Other public	329	77	23		69	100			152	94		6
Total or average	4,134	57	24	19	1,967	61	34	5	8,939	58	39	3
Middle Atlantic:												
Small private	4,209	66	28	6	1,320	46	39	15	1,486	40	13	47
Medium and large private	1,674	59	40	1	1,276	61	30	9	1,123	60	14	26
National forest	247	100			930	100						
Other public	1,297	88	12		637	100			80	21		79
Total or average	7,427	70	27	3	4,163	72	21	7	2,689	48	13	39
Lake States:												
Small private	1,515	55	29	16	1,010	56	39	5	2,129	61	23	16
Medium and large private [7]	1,254	82	18		788	80	20		1,242	78	21	1
National forest					4,813	80	20		269	100		
Other public	276	100			7,641	88	12		3,002	88	12	(6)
Total or average	3,045	70	22	8	14,252	82	17	1	6,642	77	17	6
Central:												
Small private	5,434	47	43	10	1,649	45	29	26	524	31	41	28
Medium and large private	918	47	47	6	220	32	61	7	16		100	
National forest	1,292	86	14		537	100						
Other public	419	85	15		118	100			13		79	21
Total or average	8,063	55	37	8	2,524	58	24	18	553	30	43	27
Plains:												
Small private	26	11	49	40	37			100	1			100
Medium and large private												
National forest									8	100		
Other public	6		100		11		100		4			
Total or average	32	9	58	33	48		22	78	13	81		19
Total, North:												
Small private	13,125	51	35	14	4,711	44	39	17	5,344	49	27	24
Medium and large private [7]	4,987	68	29	3	3,454	72	24	4	9,914	63	34	3
National forest	2,262	92	8		6,313	84	16		327	100		
Other public	2,327	87	13		8,476	89	11		3,251	86	11	3
Total or average	22,701	62	29	9	22,954	76	20	4	18,836	63	28	9
SOUTH												
South Atlantic:												
Small private	6,494	41	40	19	1,394	55	32	13	1,988	61	27	12
Medium and large private [7]	2,471	83	17		886	82	18		1,415	100		
National forest	1,205	100			1,153	100			186	100		
Other public	316	85	14	1	316	62	38		140	100		
Total or average	10,486	58	30	12	3,749	75	20	5	3,729	78	15	7
Southeast:												
Small private	15,266	34	34	32	4,224	37	33	30	4,703	23	23	54
Medium and large private [7]	8,529	65	27	8	4,530	90	7	3	4,219	85	4	11
National forest	1,568	100			1,839	92	8					
Other public	1,232	92	8		759	81	19		75	95	5	
Total or average	26,595	51	28	21	11,352	70	18	12	8,997	53	14	33
West Gulf:												
Small private	6,039	19	48	33	2,007	19	32	49	1,503	23	32	45
Medium and large private [7]	6,722	59	26	15	2,540	92	7	1	756	78	13	9
National forest	1,226	88	12		1,377	100						
Other public	160	47	15	38	179	21	74	5				
Total or average	14,147	44	34	22	6,103	68	15	17	2,259	42	26	32
Total, South:												
Small private	27,799	32	38	30	7,625	35	33	32	8,194	32	26	42
Medium and large private [7]	17,722	65	25	10	7,956	90	8	2	6,390	87	5	8
National forest	3,999	96	4		4,369	97	3		186	100		
Other public	1,708	82	10	8	1,254	68	31	1	215	98	2	
Total or average	51,228	50	30	20	21,204	70	17	13	14,985	57	16	27

See footnotes at end of table.

TABLE 76.—*Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by size class of primary forest products harvested, and section, region, and ownership class, 1953* [1]—Continued

WEST

Region and ownership class [2]	Large products [3]				Both large and small products [5]				Small products [4]			
	Operating area	Productivity			Operating area	Productivity			Operating area	Productivity		
		Upper	Medium	Lower		Upper	Medium	Lower		Upper	Medium	Lower
	Thousand acres	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Thousand acres*	*Percent*	*Percent*	*Percent*
Pacific Northwest:												
Douglas-fir subregion:												
Small private	2,829	61	28	11	205	64	30	6	115	64	23	13
Medium and large private	5,894	91	7	2	221	67		33	9	100		
National forest	4,328	93	7		52	100						
Other public	4,170	85	15	(6)	102	99		1	15	6		94
Total or average	17,221	86	12	2	580	75	10	15	139	60	19	2
Pine subregion:												
Small private	1,465	37	48	15					102	88	12	
Medium and large private	1,757	82	18									
National forest	6,840	90	9	1	140	100						
Other public	2,918	82	16	2								
Total or average	12,980	82	16	2	140	100			102	88	12	
Total, Pacific Northwest:												
Small private	4,294	52	35	13	205	64	30	6	217	75	18	7
Medium and large private	7,651	88	10	2	221	67		33	9	100		
National forest	11,168	92	8	(6)	192	100						
Other public	7,088	84	15	1	102	99		1	15	6		94
Total or average	30,201	84	14	2	720	80	8	12	241	72	16	12
California:												
Small private	716	57	31	12	66	61	39		10	20	80	
Medium and large private [7]	2,786	87	13		144	81	19					
National forest	5,093	77	23									
Other public	250	68	32									
Total or average	8,845	78	21	1	210	75	25		10	20	80	
Northern Rocky Mountain:												
Small private	1,238	25	61	14	2		100		88		50	50
Medium and large private	2,461	38	51	11					183	100		
National forest	16,728	71	17	12	1,577	59	41		7	100		
Other public	2,415	48	41	11	129	100						
Total or average	22,842	63	25	12	1,708	62	38		278	70	15	15
Southern Rocky Mountain:												
Small private	346	33	55	12	4	100			190	75	25	
Medium and large private	962	68	21	11	106	100						
National forest	9,407	84	16	(6)	566	70	30					
Other public	2,109	64	26	10								
Total or average	12,824	78	19	3	676	75	25		190	75	25	
Total, West:												
Small private	6,594	46	41	13	277	64	32	4	505	62	27	11
Medium and large private [7]	13,860	77	19	4	471	79	6	15	192	100		
National forest	42,396	80	15	5	2,335	65	35		7	100		
Other public	11,862	72	23	5	231	100		(6)	15	6		94
Total or average	74,712	76	19	5	3,314	70	28	2	719	72	18	10

ALL REGIONS

Region and ownership class [2]	Large products: Operating area	Upper	Medium	Lower	Both: Operating area	Upper	Medium	Lower	Small products: Operating area	Upper	Medium	Lower
United States:												
Small private	47,518	39	38	23	12,613	39	35	26	14,043	40	26	34
Medium and large private [7]	36,569	69	24	7	11,881	85	12	3	16,496	73	22	5
National forest	48,657	82	14	4	13,017	85	15		520	100		
Other public	15,897	76	20	4	9,961	87	13	(6)	3,481	86	11	3
Total or average	148,641	65	24	11	47,472	73	19	8	34,540	61	22	17
Coastal Alaska: [8]												
National forest	3,443	87	13									
Other public	781	100										
Total or average	4,224	89	11									
Total, all regions:												
Small private	47,518	39	38	23	12,613	39	35	26	14,043	40	26	34
Medium and large private [7]	36,569	69	24	7	11,881	85	12	3	16,496	73	22	5
National forest	52,100	82	14	4	13,017	85	15		520	100		
Other public	16,678	77	19	4	9,961	87	13	(6)	3,481	86	11	3
Total or average	152,865	65	24	11	47,472	73	19	8	34,540	61	22	17

[1] The determination of size class of private ownership was based on the total commercial forest land area in the ownership. The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Productivity is expressed as a percentage of operating area found to be in a high, medium, or low productivity class.

[2] "Small private" includes ownerships containing 3 to 5,000 acres of commercial forest land in the East and 10 to 5,000 acres in the West. "Medium and large private" includes ownerships of 5,000 and larger.

[3] Cuttings on which large products like saw logs, veneer logs, pulp logs, veneer bolts, or stave bolts comprise 80 percent or more of the total cubic-foot volume of products harvested.

[4] Cuttings on which both large and small products are harvested together.

[5] Cuttings on which small cordwood products such as pulpwood, distillation wood, fuelwood, and feltwood, comprise 80 percent or more of the total cubic-foot volume of products harvested.

[6] Less than 0.5 percent.

[7] Excludes operating area on some large private ownerships on which access was denied.

[8] Certain classes of private ownerships were omitted in this region because there were no ownerships of the omitted classes or they were so small that total operating area by product class could not be adequately determined by sampling procedures.

TABLE 77.—*Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by region, forest type group, ownership class, and elements of the combined productivity class, 1953* [1]

Forest type group and ownership class	Operating area	Productivity: By combined productivity class			By existing stocking, all species			By existing stocking plus prospective stocking, all species [2]			Existing and prospective stocking modified by composition			Proportion of total on which felling age factors were applied
		Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower	
NEW ENGLAND														
Small private ownerships (3 to 5,000 acres):	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
White-red-jack pine	1,166	21	38	41	32	42	26	41	38	21	31	41	28	84
Spruce-fir	1,615	43	40	17	50	26	24	68	25	7	66	25	9	87
Oak-hickory	84	60	40	-----	50	26	24	100	-----	-----	99	1	-----	100
Maple-beech-birch	975	42	42	16	58	34	8	73	22	5	64	28	8	72
Medium and large private ownerships (5,000 acres and larger):														
White-red-jack pine	281	81	14	5	88	5	7	91	5	4	84	11	5	66
Loblolly-shortleaf pine	2	-----	100	-----	100	-----	-----	100	-----	-----	-----	100	-----	100
Spruce-fir	7,228	71	28	1	86	13	1	89	11	(3)	89	11	(3)	80
Oak-pine	2	100	-----	-----	100	-----	-----	100	-----	-----	100	-----	-----	100
Oak-hickory	17	12	88		94	6		100	-----	-----	100		-----	94
Maple-beech-birch	2,314	64	32	4	81	15	4	86	13	1	72	27	1	87
Public ownerships:														
White-red-jack pine	114	74	-----	26	74	-----	26	74	-----	26	74	-----	26	51
Loblolly-shortleaf pine	5	-----	-----	100	-----	-----	100	-----	-----	100	-----	-----	100	-----
Spruce-fir	316	96	1	3	90	7	3	97	-----	3	97	-----	3	18
Oak-hickory	156	100	-----	-----	47	53	-----	100	-----	-----	100	-----		53
Maple-beech-birch	765	97	3	-----	96	4	-----	100	-----	-----	97	3	-----	41
MIDDLE ATLANTIC														
Small private ownerships (3 to 5,000 acres):														
White-red-jack pine	575	71	27	2	92	7	1	98	1	1	95	4	1	70
Spruce-fir	106	79	21	-----	64	35	1	84	16	-----	84	16	-----	48
Loblolly-shortleaf pine	397	31	26	43	30	28	42	39	24	37	36	24	40	25
Oak-pine	250	31	35	34	32	32	36	44	31	25	40	27	33	66
Oak-hickory	2,761	41	33	26	50	30	20	71	13	16	63	21	16	65
Maple-beech-birch	2,926	74	21	5	84	13	3	92	7	1	84	13	3	67
Medium and large private ownerships (5,000 acres and larger):														
White-red-jack pine	38	100	-----	-----	21	79	-----	100	-----	-----	100	-----	-----	100
Spruce-fir	351	94	6	-----	78	14	8	94	6	-----	94	6	-----	22
Loblolly-shortleaf pine	34	59	41	-----	29	71	-----	59	41	-----	59	41	-----	71
Oak-pine	8	12	-----	88	12	12	76	12	12	76	12	-----	88	-----
Oak-hickory	1,851	43	41	16	26	56	18	68	25	7	50	42	8	76
Maple-beech-birch	1,791	69	25	6	49	45	6	96	4	-----	85	11	4	58
Public ownerships:														
White-red-jack pine	77	26	74	-----	26	74	-----	26	74	-----	26	74	-----	6
Spruce-fir	6	-----	100	-----	100	-----	-----	100	-----	-----	100	-----	-----	100
Loblolly-shortleaf pine	25	100	-----	-----	96	-----	4	100	-----	-----	100	-----	-----	76
Oak-pine	4	25	50	25	25	50	25	75	25	-----	25	50	25	-----
Oak-hickory	1,371	93	6	1	60	39	1	99	1	-----	93	6	1	37
Maple-beech-birch	1,708	97	3	-----	95	5	-----	99	1	-----	97	3	-----	55
LAKE STATES														
Small private ownerships (3 to 5,000 acres):														
White-red-jack pine	433	25	54	21	17	46	37	33	53	14	27	56	17	27
Spruce-fir	560	34	47	19	27	49	24	67	28	5	49	42	9	58
Oak-hickory	622	49	39	12	64	20	16	71	26	3	55	37	8	34
Elm-ash-cottonwood	99	31	60	9	16	58	26	43	49	8	39	53	8	26
Maple-beech-birch	1,295	73	17	10	56	31	13	82	11	7	77	15	8	26
Aspen-birch	1,645	74	15	11	52	30	18	74	18	8	74	15	11	9
Medium and large private ownerships (5,000 acres and larger): [4]														
White-red-jack pine	249	73	24	3	29	48	23	84	15	1	73	24	3	6
Spruce-fir	581	75	21	4	20	73	7	76	24	-----	76	22	2	34
Oak-hickory	6	-----	100	-----	-----	100	-----	-----	100	-----	-----	100	-----	-----
Elm-ash-cottonwood	17	100	-----	-----	94	6	-----	100	-----	-----	100	-----	-----	-----
Maple-beech-birch	1,715	81	18	1	66	29	5	92	8	(3)	84	15	1	12
Aspen-birch	716	95	2	3	73	22	5	95	2	3	95	2	3	3
Public ownerships:														
White-red-jack pine	2,505	68	30	2	27	57	16	82	18	(3)	69	31	(3)	13
Spruce-fir	3,997	76	24	(3)	46	44	10	88	12	(3)	78	22	(3)	28
Oak-hickory	429	76	24	-----	43	57	-----	100	-----	-----	100	-----	-----	89
Elm-ash-cottonwood	190	30	56	14	4	69	27	58	28	14	30	56	14	-----
Maple-beech-birch	2,250	91	8	1	87	10	3	91	9	-----	91	8	1	9
Aspen-birch	6,630	85	15	(3)	55	45	(3)	90	10	-----	86	14	(3)	13

See footnotes at end of table, page 621.

TABLE 77.—*Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by region, forest type group, ownership class, and elements of the combined productivity class, 1953* [1]—Continued

Forest type group and ownership class	Operating area	Productivity: By combined productivity class			Productivity: By existing stocking, all species			Productivity: By existing stocking plus prospective stocking, all species [2]			Productivity: Existing and prospective stocking modified by composition			Proportion of total on which felling age factors were applied
		Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower	
	Thousand acres	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
CENTRAL STATES														
Small private ownerships (3 to 5,000 acres):														
Loblolly-shortleaf pine	23	13	17	70	74	13	13	87		13	22	65	13	78
Oak-pine	460	81	18	1	79	20	1	84	15	1	81	18	1	11
Oak-hickory	6,242	43	41	16	51	35	14	71	24	5	52	34	14	39
Oak-gum-cypress	265	51	27	22	34	40	26	73	9	18	55	26	19	60
Elm-ash-cottonwood	447	39	50	11	31	64	5	85	12	3	43	57	(3)	46
Maple-beech-birch	170	40	49	11	73	22	5	90	10		50	42	8	29
Medium and large private ownerships (5,000 acres and larger):														
Loblolly-shortleaf pine	12	75	25		67	33		75	25		75	25		25
Oak-pine	75	45	40	15	43	56	1	81	19		61	24	15	33
Oak-hickory	1,059	43	50	7	40	44	16	72	27	1	63	31	6	52
Maple-beech-birch	8		100		100			100				100		
Public ownerships:														
White-red-jack pine	1	100			100			100			100			
Loblolly-shortleaf pine	176	100			79	21		100			100			1
Oak-pine	390	83	17		84	15	1	99	1		83	17		7
Oak-hickory	1,766	89	11	(3)	79	21		95	5		89	11		1
Oak-gum-cypress	6	17	83		100			100			17	83		
Elm-ash-cottonwood	38	100			16	84		100			100			
Maple-beech-birch	2	100			100			100			100			
PLAINS														
Small private ownerships (3 to 5,000 acres):														
Oak-hickory	50	8	28	64	50	44	6	62	36	2	58	28	14	50
Elm-ash-cottonwood	14		29	71	14	86		14	86			43	57	14
Public ownerships:														
White-red-jack pine	8	100			100			100			100			
Oak-hickory	5			100	100			100			100			100
Aspen-birch	16		100		56		44	56	44			100		56
SOUTH ATLANTIC														
Small private ownerships (3 to 5,000 acres):														
Longleaf-slash pine	614	23	31	46	12	31	57	47	20	33	34	30	36	87
Loblolly-shortleaf pine	6,815	44	39	17	48	35	17	57	33	10	52	34	14	45
Oak-pine	767	67	22	11	56	31	13	77	15	8	76	16	8	35
Oak-hickory	1,424	38	53	9	48	25	27	61	35	4	51	45	4	45
Oak-gum-cypress	256	35	65		16	58	26	46	54		39	61		33
Medium and large private ownerships (5,000 acres and larger): [4]														
Longleaf-slash pine	438	78	17	5	64	30	6	94	6		78	22		27
Loblolly-shortleaf pine	2,329	93	3	4	70	26	4	94	6		93	3	4	13
Oak-pine	517	90	10		88	11	1	90	10		90	10		22
Oak-hickory	712	93	5	2	68	30	2	97	1	2	93	5	2	55
Oak-gum-cypress	776	65	35		63	27	10	94	6		68	32		17
Public ownerships:														
Longleaf-slash pine	278	83	1	16	42	39	19	83	1	16	83	1	16	20
Loblolly-shortleaf pine	720	90	9	1	81	17	2	95	4	1	95	4	1	13
Oak-pine	362	100	(3)		96	4		100			100			16
Oak-hickory	1,870	91	9		70	30		91	9		91	9		2
Oak-gum-cypress	86	88	6	6	32	64	4	88	12		88	6	6	6
SOUTHEAST														
Small private ownerships (3 to 5,000 acres):														
Longleaf-slash pine	6,586	31	32	37	10	44	46	40	29	31	40	28	32	46
Loblolly-shortleaf pine	10,213	36	27	37	46	26	28	51	27	22	50	27	23	71
Oak-pine	1,659	32	26	42	22	33	45	41	29	30	39	29	32	56
Oak-hickory	4,087	44	43	13	37	42	21	60	35	5	47	43	10	47
Oak-gum-cypress	1,648	33	47	20	23	22	55	59	25	16	40	41	19	74
Medium and large private ownerships (5,000 acres and larger): [4]														
Longleaf-slash pine	10,226	75	14	11	24	52	24	75	15	10	75	15	10	11
Loblolly-shortleaf pine	3,733	79	14	7	65	29	6	87	8	5	87	8	5	28
Oak-pine	399	71	28	1	42	52	6	72	28	(3)	72	28	(3)	15
Oak-hickory	1,199	78	19	3	25	63	12	86	11	3	78	19	3	21
Oak-gum-cypress	1,721	79	21		48	37	15	82	18		79	21		13

See footnotes at end of table.

TABLE 77.—*Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by region, forest type group, ownership class, and elements of the combined productivity class, 1953* [1]—Continued

SOUTHEAST—Continued

Forest type group and ownership class	Operating area	Productivity												Proportion of total on which felling age factors were applied
		By combined productivity class			By existing stocking, all species			By existing stocking plus prospective stocking, all species [2]			Existing and prospective stocking modified by composition			
		Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower	
	Thousand acres	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Public ownerships:														
Longleaf-slash pine	2,161	96	4	----	14	82	4	96	4	----	96	4	----	3
Loblolly-shortleaf pine	1,440	83	16	1	50	33	17	95	5	----	95	5	----	15
Oak-pine	669	90	5	5	49	40	11	95	----	5	90	5	5	1
Oak-hickory	964	90	7	3	43	52	5	97	3	----	92	5	3	3
Oak-gum-cypress	239	80	12	8	22	61	17	82	10	8	82	10	8	5
WEST GULF														
Small private ownerships (3 to 5,000 acres):														
Longleaf-slash pine	435	10	41	49	14	25	61	15	38	47	15	38	47	30
Loblolly-shortleaf pine	4,206	21	28	51	25	29	46	30	37	33	29	37	34	69
Oak-pine	997	27	47	26	14	45	41	43	47	10	40	49	11	68
Oak-hickory	2,035	22	67	11	22	36	42	50	46	4	49	47	4	71
Oak-gum-cypress	1,876	16	60	24	16	37	47	37	52	11	30	50	20	72
Medium and large private ownerships (5,000 acres and larger): [4]														
Longleaf-slash pine	1,406	77	9	14	54	17	29	79	7	14	77	9	14	14
Loblolly-shortleaf pine	4,984	77	19	4	47	46	7	79	18	3	79	18	3	19
Oak-pine	415	44	24	32	49	20	31	63	12	25	63	12	25	46
Oak-hickory	106	28	72	----	8	92	----	37	63	----	30	70	----	53
Oak-gum-cypress	3,107	39	44	17	23	35	42	46	44	10	41	40	19	38
Public ownerships:														
Longleaf-slash pine	274	82	17	1	73	26	1	99	----	1	82	17	1	5
Loblolly-shortleaf pine	1,368	95	3	2	77	20	3	95	4	1	95	3	2	2
Oak-pine	185	94	6	----	78	20	2	94	6	----	94	6	----	----
Oak-hickory	974	45	55	----	5	66	29	45	55	----	45	55	----	----
Oak-gum-cypress	141	10	54	36	2	36	62	31	33	36	20	44	36	23
DOUGLAS-FIR SUBREGION														
Small private ownerships (10 to 5,000 acres):														
Douglas-fir	2,786	59	28	13	27	44	29	67	25	8	66	26	8	55
Hemlock-Sitka spruce	280	63	34	3	41	37	22	73	24	3	68	29	3	46
Ponderosa pine	41	88	12	----	44	44	12	88	12	----	88	12	----	56
Western white pine	5	100	----	----	20	80	----	100	----	----	100	----	----	----
Fir-spruce	24	46	----	54	----	96	4	100	----	----	46	----	54	----
Hardwoods	13	15	85	----	54	31	15	54	46	----	15	85	----	----
Medium and large private ownerships (5,000 acres and larger):														
Douglas-fir	4,204	86	10	4	50	41	9	86	10	4	86	10	4	13
Hemlock-Sitka spruce	1,750	95	1	4	91	5	4	95	5	----	95	5	----	30
Ponderosa pine	9	100	----	----	100	----	----	100	----	----	100	----	----	----
Fir-spruce	161	100	----	----	92	4	4	100	----	----	100	----	----	----
Public ownerships:														
Douglas-fir	6,971	85	12	3	52	46	2	86	13	1	85	14	1	17
Hemlock-Sitka spruce	1,184	94	6	(3)	69	16	15	94	6	----	94	6	----	37
Ponderosa pine	136	100	----	----	100	----	----	100	----	----	100	----	----	----
Western white pine	3	100	----	----	100	----	----	100	----	----	100	----	----	----
Lodgepole pine	11	100	----	----	100	----	----	100	----	----	100	----	----	----
Fir-spruce	361	100	----	----	65	32	3	100	----	----	100	----	----	----
Hardwoods	1	----	100	----	----	100	----	----	100	----	----	100	----	----
PINE SUBREGION														
Small private ownerships (10 to 5,000 acres):														
Douglas-fir	305	47	33	20	43	43	14	62	33	5	54	38	8	75
Ponderosa pine	1,205	31	57	12	23	61	16	50	47	3	44	50	6	54
Lodgepole pine	31	94	6	----	94	----	6	94	6	----	94	6	----	----
Fir-spruce	26	73	15	12	38	62	----	73	27	----	73	15	12	----
Medium and large private ownerships (5,000 acres and larger):														
Douglas-fir	297	85	15	----	34	62	4	89	11	----	86	14	----	5
Ponderosa pine	1,337	89	11	----	66	30	4	92	8	----	89	11	----	1
Western white pine	11	----	100	----	----	91	9	----	100	----	----	100	----	9
Larch	60	33	67	----	87	----	13	87	13	----	33	67	----	----
Fir-spruce	52	100	----	----	100	----	----	100	----	----	100	----	----	----

See footnotes at end of table.

TABLE 77.—*Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by region, forest type group, ownership class, and elements of the combined productivity class, 1953* [1]—Continued

PINE SUBREGION—Continued

Forest type group and ownership class	Operating area	Productivity: By combined productivity class			By existing stocking, all species			By existing stocking plus prospective stocking, all species [2]			Existing and prospective stocking modified by composition			Proportion of total on which felling age factors were applied
		Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower	
	Thousand acres	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Public ownerships:														
Douglas-fir	857	82	16	2	23	67	10	87	13	(3)	82	16	2	17
Hemlock-Sitka spruce	25	100					100	100			100			100
Ponderosa pine	7,029	86	13	1	67	32	1	88	11	1	86	13	1	1
Western white pine	110		90	10		90	10		90	10		90	10	
Lodgepole pine	763	100			69	26	5	100			100			
Larch	534	60	39	1	58	41	1	63	36	1	60	39	1	
Fir-spruce	580	90	10	(3)	48	43	9	100	(3)		90	10	(3)	
PACIFIC NORTHWEST														
Small private ownerships (10 to 5,000 acres):														
Douglas-fir	3,091	58	29	13	28	44	28	67	26	7	65	27	8	57
Hemlock-Sitka spruce	280	64	33	3	41	37	22	73	24	3	68	29	3	46
Ponderosa pine	1,246	33	56	11	24	61	15	51	46	3	45	49	6	54
Western white pine	5	100			20	80		100			100			
Lodgepole pine	31	94	6		94		6	94	6		94	6		
Fir-spruce	50	60	8	32	20	78	2	86	14		60	8	32	
Hardwoods	13	15	85		54	31	15	54	46		15	85		
Medium and large private ownerships (5,000 acres and larger):														
Douglas-fir	4,501	85	11	4	49	42	9	86	10	4	86	10	4	12
Hemlock-Sitka spruce	1,750	95	1	4	91	5	4	95	5		95	5		30
Ponderosa pine	1,346	89	11		66	30	4	92	8		89	11		1
Western white pine	11		100			91	9		100			100		9
Larch	60	33	67		87		13	87	13		33	67		
Fir-spruce	213	100			94	3	3	100			100			
Public ownerships:														
Douglas-fir	7,828	84	13	3	49	48	3	86	13	1	85	14	1	17
Hemlock-Sitka spruce	1,209	94	6	(3)	68	15	17	94	6		94	6		38
Ponderosa pine	7,165	87	12	1	67	32	1	88	11	1	87	12	1	1
Western white pine	113	3	87	10	3	87	10	3	87	10	3	87	10	
Lodgepole pine	774	100			69	26	5	100			100			
Larch	534	60	39	1	58	41	1	63	36	1	60	39	1	
Fir-spruce	941	94	6	(3)	54	39	7	100	(3)		94	6	(3)	
Hardwoods	1		100			100			100		100	100		
CALIFORNIA														
Small private ownerships (10 to 5,000 acres):														
Douglas-fir	261	75	24	1	6	43	51	76	23	1	75	24	1	
Redwood	161	75	25		32	54	14	75	25		75	25		
Ponderosa pine	350	41	36	23	28	50	22	45	36	19	41	36	23	5
Fir-spruce	20		100			60	40		100			100		
Medium and large private ownerships (5,000 acres and larger): [4]														
Douglas-fir	521	81	19		32	23	45	81	19		81	19		
Redwood	716	90	10		57	26	17	90	10		90	10		
Ponderosa pine	1,266	85	15		36	64		85	15		85	15		5
Western white pine	85	90	10		70	30		97	3		90	10		
Fir-spruce	342	100			71	29		100			100			
Public ownerships:														
Douglas-fir	1,143	78	22		11	73	16	78	22		78	22		
Redwood	66	100			21		79	100			100			
Ponderosa pine	3,214	71	29		48	44	8	75	25		71	29		
Western white pine	150	72	28		65	35		86	14		72	28		
Fir-spruce	770	80	20		50	47	3	80	20		80	20		

See footnotes at end of table.

TABLE 77.—*Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by region, forest type group, ownership class, and elements of the combined productivity class, 1953* [1]—Continued

Forest type group and ownership class	Operating area	Productivity: By combined productivity class			Productivity: By existing stocking, all species			Productivity: By existing stocking plus prospective stocking, all species [2]			Productivity: Existing and prospective stocking modified by composition			Proportion of total on which felling age factors were applied
		Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower	
	Thousand acres	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
NORTHERN ROCKY MOUNTAIN														
Small private ownerships (10 to 5,000 acres):														
Douglas-fir	308	25	60	15	19	52	29	27	70	3	27	70	3	50
Ponderosa pine	572	14	58	28	3	85	12	42	57	1	22	66	12	28
Western white pine	166	25	58	17	25	58	17	25	58	17	25	58	17	48
Lodgepole pine	61		51	49	5	95		5	95			51	49	92
Larch	209	76	24		65	32	3	79	21		76	24		52
Fir-spruce	12		100			100			100			100		
Medium and large private ownerships (5,000 acres and larger):														
Douglas-fir	350	60	32	8	32	61	7	77	23		60	32	8	5
Ponderosa pine	890	41	50	9	23	65	12	51	49		41	50	9	2
Western white pine	373	19	65	16	6	69	25	19	65	16	19	65	16	50
Lodgepole pine	334	96	4		45	54	1	96	4		96	4		
Larch	617	34	59	7	84	16		93	7		34	59	7	1
Fir-spruce	80	15	25	60	6	19	75	15	25	60	15	25	60	
Public ownerships:														
Douglas-fir	4,894	70	26	4	28	68	4	70	27	3	70	26	4	8
Ponderosa pine	4,222	83	15	2	24	74	2	86	14	(3)	83	15	2	6
Western white pine	1,579	12	44	44		44	56	12	45	43	12	44	44	
Lodgepole pine	5,838	86	9	5	32	57	11	90	6	4	86	9	5	1
Larch	2,175	38	41	21	(3)	99	1	44	56		38	41	21	
Fir-spruce	2,148	34	45	21	7	54	39	34	45	21	34	45	21	
SOUTHERN ROCKY MOUNTAIN														
Small private ownerships (10 to 5,000 acres):														
Douglas-fir	34	9	91		6	94		79	21		79	21		91
Ponderosa pine	241	29	52	19	20	33	47	30	55	15	29	52	19	4
Lodgepole pine	233	78	22			29	71	98	2		98	2		20
Fir-spruce	23	17	83		4	96		17	83		17	83		
Hardwoods	9	100				100		100			100			
Medium and large private ownerships (5,000 acres and larger):														
Douglas-fir	23	100			17	83		100			100			
Ponderosa pine	808	57	27	16	9	70	21	57	27	16	57	27	16	16
Lodgepole pine	24	100				33	67	100			100			
Fir-spruce	213	82	18		56	26	18	82	18		82	18		
Public ownerships:														
Douglas-fir	158	100			59	41		100			100			
Ponderosa pine	7,136	71	25	4	31	56	13	73	24	3	71	25	4	
Lodgepole pine	1,666	96	4	(3)	31	40	29	98	2		96	4	(3)	
Fir-spruce	2,746	91	8	1	36	64		94	6		91	8	1	
Hardwoods	376	77	23		37	63		77	23		77	23		
COASTAL ALASKA														
Public ownerships:														
Hemlock-Sitka spruce	4,224	89	11		87	13		89	11		89	11		
ALL REGIONS														
Small private ownerships (under 5,000 acres): [5]														
Eastern type groups:														
White-red-jack pine	2,174	35	38	27	45	33	22	54	31	15	47	34	19	69
Spruce-fir	2,281	42	41	17	45	32	23	69	25	6	63	29	8	78
Longleaf-slash pine	7,635	29	33	38	10	42	48	39	29	32	38	29	33	48
Loblolly-shortleaf pine	21,654	36	31	33	43	29	28	49	31	20	47	31	22	61
Oak-pine	4,133	43	30	27	33	34	33	53	29	18	51	30	19	50
Oak-hickory	17,305	40	44	16	44	35	21	66	28	6	52	37	11	49
Oak-gum-cypress	4,045	26	53	21	20	32	48	49	38	13	36	46	18	70
Elm-ash-cottonwood	560	37	51	12	28	64	8	76	20	4	41	55	4	42
Maple-beech-birch	5,366	67	25	8	72	21	7	86	11	3	78	17	5	57
Aspen-birch	1,645	74	15	11	52	30	18	74	18	8	74	15	11	9
Western type groups:														
Douglas-fir	3,694	56	32	12	26	45	29	64	29	7	62	31	7	52
Hemlock-Sitka spruce	280	64	34	2	41	37	22	74	24	2	69	29	2	46
Redwood	161	75	25		32	54	14	75	25		75	25		
Ponderosa pine	2,409	29	53	18	19	62	19	46	48	6	37	52	11	35
Western white pine	171	27	57	16	25	59	16	27	57	16	27	57	16	47
Lodgepole pine	325	65	26	9	10	38	52	80	20		79	12	9	32
Larch	209	76	24		65	33	2	79	21		76	24		52
Fir-spruce	105	32	52	16	10	81	9	45	55		32	52	16	
Hardwoods	22	50	50		32	59	9	73	27		50	50		

See footnotes at end of table.

TABLE 77.—*Productivity of recently cut commercial forest land in the United States and Coastal Alaska, by region, forest type group, ownership class, and elements of the combined productivity class, 1953* [1]—Continued

ALL REGIONS—Continued

Forest type group and ownership class	Operating area	Productivity												Proportion of total on which felling age factors were applied
		By combined productivity class			By existing stocking, all species			By existing stocking plus prospective stocking, all species [2]			Existing and prospective stocking modified by composition			
		Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower	Upper	Medium	Lower	
Medium and large private ownerships (5,000 acres and larger): [4]	*Thousand acres*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Eastern type groups:														
White-red-jack pine	568	79	17	4	58	28	14	89	9	2	80	16	4	42
Spruce-fir	8,160	73	26	1	81	17	2	88	12	(3)	88	12	(3)	75
Longleaf-slash pine	12,070	75	13	12	29	47	24	76	14	10	75	15	10	14
Loblolly-shortleaf pine	11,094	81	14	5	58	36	6	85	12	3	84	11	5	21
Oak-pine	1,416	68	21	11	61	28	11	76	16	8	75	16	9	28
Oak-hickory	4,950	59	33	8	35	52	13	77	19	4	65	29	6	54
Oak-gum-cypress	5,604	55	36	9	36	34	30	63	31	6	56	33	11	27
Elm-ash-cottonwood	17	100	--------	--------	94	6	--------	100	--------	--------	100	--------	--------	--------
Maple-beech-birch	5,828	71	26	3	67	29	4	91	9	(3)	79	19	2	56
Aspen-birch	716	95	2	3	73	22	5	95	2	3	95	2	3	3
Western type groups:														
Douglas-fir	5,395	83	13	4	46	42	12	85	12	3	84	12	4	11
Hemlock-Sitka spruce	1,750	95	1	4	91	5	4	95	5	--------	95	5	--------	30
Redwood	716	90	10	--------	58	26	16	90	10	--------	90	10	--------	--------
Ponderosa pine	4,310	72	23	5	28	55	7	75	22	3	72	23	5	3
Western white pine	469	31	56	13	17	63	20	32	55	13	31	56	13	40
Lodgepole pine	358	96	4	--------	42	53	5	96	4	--------	96	4	--------	--------
Larch	677	34	60	6	84	15	1	93	7	--------	34	60	6	1
Fir-spruce	848	88	7	5	67	21	12	88	7	5	88	7	5	--------
Public ownerships:														
Eastern type groups:														
White-red-jack pine	2,705	68	30	2	29	55	16	80	19	1	68	31	1	15
Spruce-fir	4,319	77	23	(3)	49	42	9	89	11	(3)	80	20	(3)	27
Longleaf-slash pine	2,713	93	5	2	23	72	5	95	3	2	93	5	2	5
Loblolly-shortleaf pine	3,734	90	9	1	68	24	8	95	4	1	95	4	1	10
Oak-pine	1,610	91	7	2	71	24	5	97	1	2	91	7	2	1
Oak-hickory	7,535	85	15	1	56	39	5	89	11	--------	86	14	(3)	14
Oak-gum-cypress	472	60	24	16	19	53	28	68	17	15	64	20	16	10
Elm-ash-cottonwood	228	42	47	11	6	71	23	66	23	11	42	47	11	--------
Maple-beech-birch	4,725	94	5	1	91	8	1	96	4	--------	94	5	1	31
Aspen-birch	6,646	85	15	(3)	55	44	1	90	10	--------	85	15	(3)	13
Western type groups:														
Douglas-fir	14,023	79	18	3	38	57	5	80	18	2	79	18	3	12
Hemlock-Sitka spruce	5,433	90	10	(3)	83	14	3	90	10	--------	90	10	--------	8
Redwood	66	100	--------	--------	21	--------	79	100	--------	--------	100	--------	--------	--------
Ponderosa pine	21,737	79	19	2	44	50	6	81	18	1	79	19	2	2
Western white pine	1,842	16	46	38	5	46	49	17	46	37	16	46	38	--------
Lodgepole pine	8,278	90	7	3	35	51	14	92	5	3	90	7	3	1
Larch	2,709	42	40	18	12	87	1	48	52	(3)	42	40	18	--------
Fir-spruce	6,605	72	21	7	31	55	14	74	19	7	72	21	7	--------
Hardwoods	377	77	23	--------	37	63	--------	77	23	--------	77	23	--------	--------

[1] The determination of size class of private ownership was based on the total commercial forest land area in the ownership. The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done since January 1, 1947. The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. Productivity is expressed as a percentage of the operating area ound to be in a high, medium, or low productivity class according to measurement of the four elements taken into account in arriving at a combined productivity index.

[2] For eastern type groups, prospective stocking estimated for desirable species only.

[3] Less than 0.5 percent.

[4] Excludes operating area on some large private ownerships on which access was denied.

[5] Includes ownerships containing 3 to 5,000 acres of commercial forest land in the East and 10 to 5,000 acres in the West.

TABLE 78.—*Estimated domestic consumption and domestic output of timber products in the United States and Coastal Alaska by softwoods and hardwoods, 1952, and projections of domestic demand and domestic output, 1975 and 2000* [1]

Product and species group	Standard unit of measure [2]	Domestic consumption, 1952 [3]	Projections of domestic demand: 1975 Lower	Projections of domestic demand: 1975 Medium	Projections of domestic demand: 2000 Lower	Projections of domestic demand: 2000 Medium	Projections of domestic demand: 2000 Upper	Domestic output, 1952	Projections of domestic output: 1975 Lower	Projections of domestic output: 1975 Medium	Projections of domestic output: 2000 Lower	Projections of domestic output: 2000 Medium	Projections of domestic output: 2000 Upper
Saw logs (for lumber, timbers, sawn ties, etc.):		*Million units*	*Million units*	*Million units*	*Million units*	*Million units*	*Million units*	*Million units*	*Million units*	*Million units*	*Million units*	*Million units*	*Million units*
Softwood	Bd.-ft. lbr. tally	33,408	36,800	42,400	41,100	58,900	67,000	31,507	33,900	39,500	38,200	56,000	64,100
Hardwood	do	8,054	10,800	13,100	13,700	20,100	23,000	8,003	10,700	13,000	13,600	20,000	22,900
Total [4]	do	41,462	47,600	55,500	54,800	79,000	90,000	39,510	44,600	52,500	51,800	76,000	87,000
Pulpwood:													
Softwood	Standard cords	31.3	48	53	67	74	89	21.4	35	40	53	60	75
Hardwood	do	4.1	17	19	23	26	36	3.7	16	18	22	25	35
Total [5]	do	35.4	65	72	90	100	125	25.1	51	58	75	85	110
Veneer logs and bolts:													
Softwood	Bd.-ft. log scale	1,628	3,400	3,920	4,920	6,000	7,000	1,548	3,270	3,790	4,720	5,800	6,900
Hardwood	do	1,019	1,600	1,750	2,580	3,000	3,500	919	1,100	1,250	1,850	2,270	2,770
Total [6]	do	2,647	5,000	5,670	7,500	9,000	10,500	2,467	4,370	5,040	6,570	8,070	9,570
Cooperage logs and bolts:													
Softwood	Bd.-ft. log scale	117.9	152	200				117.9	152	200			
Hardwood	do	237.4	358	400				237.4	358	400			
Total	do	355.3	510	600				355.3	510	600			
Piling:													
Softwood	Linear feet	37.9	40	53				37.9	40	53			
Hardwood	do	3.3	5	6				3.3	5	6			
Total	do	41.2	45	59				41.2	45	59			
Poles:													
Softwood	Pieces	6.4	4.8	6.4				6.4	4.8	6.4			
Hardwood	do	.1	.1	.1				.1	.1	.1			
Total	do	6.5	4.9	6.5	*Million cu. ft.* (Not allocated to product)	*Million cu. ft.*	*Million cu. ft.*	6.5	4.9	6.5	*Million cu. ft.* (Not allocated to product)	*Million cu. ft.*	*Million cu. ft.*
Posts (round and split):													
Softwood	do	103.3	105	140	580	725	870	103.3	105	140	580	725	870
Hardwood	do	202.7	232	260	580	725	870	202.7	232	260	580	725	870
Total	do	306.0	337	400	1,160	1,450	1,740	306.0	337	400	1,160	1,450	1,740
Hewn ties:													
Softwood	do	3.7						3.7					
Hardwood	do	6.5						6.5					
Total	do	10.2						10.2					
Mine timbers (round):													
Softwood	Cubic feet	18.5	20	26				18.5	20	26			
Hardwood	do	62.5	67	79				62.5	67	79			
Total	do	81.0	87	105				81.0	87	105			
Other industrial wood: [7]													
Softwood	do	112.3	157	175				112.3	157	175			
Hardwood	do	114.7	157	175				114.7	157	175			
Total	do	227.0	314	350				227.0	314	350			
Fuelwood: [8]					*Million units*	*Million units*	*Million units*				*Million units*	*Million units*	*Million units*
Softwood	Standard cords	31.1	18	18	15	15	15	31.1	18	18	15	15	15
Hardwood	do	27.5	16	16	10	10	10	27.5	16	16	10	10	10
Total	do	58.6	34	34	25	25	25	58.6	34	34	25	25	25

[1] See section on Future Demand for Timber for basic assumptions governing lower, medium, and upper projections of demand, 1975 and 2000.
[2] Units are those commonly used by the Bureau of the Census, the trade, or other agencies reporting volume of output or consumption.
[3] Estimates of apparent consumption based on estimated production, less exports plus imports and changes in domestic stocks.
[4] Includes 1,752 million board-feet net imports of lumber plus 200 million board-feet net withdrawals from lumber stocks, 1952; and 3 billion board-feet net imports of lumber, 1975 and 2000.
[5] Includes 11.2 million cords net imports of pulpwood and pulpwood equivalent of woodpulp and paper less net additions to pulpwood stocks of 900 thousand cords, 1952; 14 million cords net imports of pulpwood and pulpwood equivalent of woodpulp and paper, 1975, and 15 million cords in 2000.
[6] Includes 180 million board-feet net imports of veneer logs and bolts or veneer-log equivalent of veneer and veneer products, 1952; 630 million board-feet in 1975 and 930 million board-feet in 2000.
[7] Includes such products as box bolts, shingle logs and bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, split stakes and shakes, and miscellaneous farm timbers.
[8] For domestic and industrial use.

TABLE 79.—*Estimated domestic consumption of roundwood in the United States and Coastal Alaska by product and by softwoods and hardwoods, 1952, and projections of domestic demand, 1975 and 2000* [1]

Product and species group	Domestic consumption 1952	Projections of domestic demand				
		1975		2000		
		Lower	Medium	Lower	Medium	Upper
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Saw logs (for lumber, timbers, sawn ties, etc.):						
Softwood	5,186	5,444	6,368	6,309	8,850	9,877
Hardwood	1,233	1,696	2,015	2,240	3,240	3,701
Total [2]	6,419	7,140	8,383	8,549	12,090	13,578
Pulpwood:						
Softwood	2,384	3,416	3,852	4,714	5,107	6,117
Hardwood	313	1,282	1,412	1,800	2,018	2,808
Total [3]	2,697	4,698	5,264	6,514	7,125	8,925
Veneer logs and bolts:						
Softwood	262	560	631	800	910	1,058
Hardwood	189	300	315	501	568	666
Total [4]	451	860	946	1,301	1,478	1,724
Cooperage logs and bolts:						
Softwood	26	32	41			
Hardwood	47	65	68			
Total	73	97	109			
Piling:						
Softwood	26	27	34			
Hardwood	2	3	3			
Total	28	30	37			
Poles:						
Softwood	87	66	87			
Hardwood	1	1	1			
Total	88	67	88			
Posts (round and split):				Not allocated to product		
Softwood	69	66	86	505	586	703
Hardwood	125	109	138	538	641	770
Total	194	175	224	1,043	1,227	1,473
Hewn ties:						
Softwood	23	...	...			
Hardwood	44	...	...			
Total	67	...	...			
Mine timbers (round):						
Softwood	19	20	26			
Hardwood	62	67	79			
Total	81	87	105			
Other industrial wood: [5]						
Softwood	76	104	112			
Hardwood	92	115	120			
Total	168	219	232			
Total all industrial wood:						
Softwood	8,158	9,735	11,237	12,328	15,453	17,755
Hardwood	2,108	3,638	4,151	5,079	6,467	7,945
Total	10,266	13,373	15,388	17,407	21,920	25,700
Fuelwood:						
Softwood	476	180	180	154	154	154
Hardwood	1,532	638	638	365	365	365
Total	2,008	818	818	519	519	519
Total all timber products:						
Softwood	8,634	9,915	11,417	12,482	15,607	17,909
Hardwood	3,640	4,276	4,789	5,444	6,832	8,310
Total	12,274	14,191	16,206	17,926	22,439	26,219

[1] See section on Future Demand for Timber for basic assumptions governing lower, medium, and upper projections of demand, 1975 and 2000. The roundwood (logs and bolts) includes only that cut directly from trees. Plant residues utilized for such products as pulpwood, "other industrial wood," and fuelwood are part of the roundwood volume principally of saw logs and veneer logs and bolts. Volumes are in cubic feet excluding bark.

[2] Includes 273 million cubic feet saw-log equivalent of net imports of lumber 1952, and 470 million cubic feet saw-log equivalent of net imports of lumber in 1975 and 2000.

[3] Includes 874 million cubic feet net imports of pulpwood and pulpwood equivalent of woodpulp and paper 1952; 1,092 million cubic feet in 1975 and 1,170 million cubic feet in 2000.

[4] Includes 29 million cubic feet net imports of veneer logs and bolts or veneer-log equivalent of veener and veneer products 1952; 99 million cubic feet in 1975 and 147 million cubic feet in 2000.

[5] Includes such products as box bolts, shingle logs and bolts, excelsior bolts, turnery, dimension and handle stock, chemical wood, split stakes and shakes, and miscellaneous farm timbers.

TABLE 80.—*Estimated timber cut in the United States and Coastal Alaska by product and softwoods and hardwoods, 1952, and projections of timber cut from growing stock and live sawtimber, 1975 and 2000* [1]

Product and species group	Growing stock: Timber cut 1952	Growing stock: Projections of timber cut [2] 1975 Lower	1975 Medium	2000 Lower	2000 Medium	2000 Upper	Live sawtimber: Timber cut 1952	Live sawtimber: Projections of timber cut [2] 1975 Lower	1975 Medium	2000 Lower	2000 Medium	2000 Upper
Saw logs (for lumber, timbers, sawn ties, etc.):	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*	*Million bd.-ft.*
Softwood	5, 214	5, 438	6, 203	6, 030	8, 279	9, 486	28, 890	30, 827	35, 950	34, 786	50, 990	58, 330
Hardwood	1, 607	1, 924	2, 216	2, 555	3, 624	4, 145	7, 746	9, 878	12, 000	12, 524	18, 470	21, 137
Total	6, 821	7, 362	8, 419	8, 585	11, 903	13, 631	36, 636	40, 705	47, 950	47, 310	69, 460	79, 467
Pulpwood:												
Softwood	1, 460	2, 038	2, 284	2, 997	3, 195	3, 975	4, 252	5, 285	6, 040	7, 897	8, 980	11, 175
Hardwood	267	1, 050	1, 115	1, 484	1, 638	2, 275	441	1, 936	2, 178	2, 596	2, 955	4, 130
Total	1, 727	3, 088	3, 399	4, 481	4, 833	6, 250	4, 693	7, 221	8, 218	10, 493	11, 935	15, 305
Veneer logs and bolts:												
Softwood	251	537	611	760	878	1, 027	1, 575	3, 300	3, 829	4, 767	5, 858	6, 868
Hardwood	241	289	310	511	605	736	1, 228	1, 399	1, 590	2, 359	2, 896	3, 532
Total	492	826	921	1, 271	1, 483	1, 763	2, 803	4, 699	5, 419	7, 126	8. 754	10. 400
Cooperage logs and bolts:												
Softwood	29	37	48				143	188	248			
Hardwood	76	102	114				373	540	602			
Total	105	139	162				516	728	850			
Piling:												
Softwood	30	31	40				148	159	210			
Hardwood	2	3	4				11	17	19			
Total	32	34	44				159	176	229			
Poles:												
Softwood	100	69	91				466	354	467			
Hardwood	1	1	1				4	6	7			
Total	101	70	92				470	360	474			
				Not allocated to product						Not allocated to product		
Posts (round and split):												
Softwood	49	48	62	426	538	645	69	71	94	1, 885	2, 357	2, 827
Hardwood	82	80	85	568	630	755	149	93	104	1, 519	1, 899	2, 279
Total	131	128	147	994	1, 168	1, 400	218	164	198	3, 404	4, 256	5, 106
Hewn ties:												
Softwood	32	----	----				152	----	----			
Hardwood	77	----	----				331	----	----			
Total	109	----	----				483	----	----			
Mine timbers (round):												
Softwood	19	20	26				41	46	61			
Hardwood	58	62	74				59	73	81			
Total	77	82	100				100	119	142			
Other industrial wood:												
Softwood	60	81	88				215	287	378			
Hardwood	98	118	123				301	363	404			
Total	158	199	211				516	650	782			
Total all industrial wood: [3]												
Softwood	7, 244	8, 299	9, 453	10, 213	12, 890	15, 133	35, 951	40, 517	47, 277	49, 335	68, 185	79, 200
Hardwood	2, 509	3, 629	4, 042	5, 118	6, 497	7, 911	10, 643	14, 305	16, 985	18, 998	26, 220	31, 078
Total	9, 753	11. 928	13, 495	15, 331	19, 387	23, 044	46, 594	54, 822	64, 262	68, 333	94, 405	110, 278
Fuelwood:												
Softwood	243	104	104	95	95	95	595	343	343	225	225	225
Hardwood	761	395	395	231	231	231	1, 651	825	825	450	450	450
Total	1, 004	499	499	326	326	326	2, 246	1, 168	1, 168	675	675	675
Total all timber products:												
Softwood	7, 487	8, 403	9, 557	10. 308	12, 985	15, 228	36, 546	40, 860	47, 620	49, 560	68, 410	79, 425
Hardwood	3, 270	4, 024	4, 437	5, 349	6, 728	8, 142	12, 294	15, 130	17, 810	19, 448	26, 670	31, 528
Total	10, 757	12, 427	13, 994	15, 657	19, 713	23, 370	48, 840	55, 990	65, 430	69, 008	95, 080	110, 953

[1] See section on Future Demand for Timber for basic assumptions governing lower, medium, and upper projections of demand, 1975 and 2000.

[2] Volume of forest growing stock and live sawtimber that would have to be cut from domestic forests to meet projections of domestic demand for timber products in 1975 and 2000. Timber cut of growing stock is expressed in cubic feet (roundwood) excluding bark and for live sawtimber in board-feet log scale, International 1/4-inch rule.

[3] Includes such products as box bolts, turnery, dimension and handle stock, shingle logs and bolts, excelsior bolts, chemical wood, split stakes and shakes, and miscellaneous farm timbers.

TABLE 81.—*Estimated domestic consumption, domestic output of timber products, and domestic timber cut in the United States and Coastal Alaska, by product groups, 1952, and projections of domestic demand, output, and timber cut, 1975 and 2000* [1]

Item	Standard unit of measure [2]	1952	1975 Lower	1975 Medium	2000 Lower	2000 Medium	2000 Upper
SOFTWOODS							
		Million units	*Million units*	*Million units*	*Million units*	*Million units*	*Million units*
All industrial wood:							
Domestic consumption or demand	Cubic feet roundwood	8,158	9,735	11,237	12,328	15,453	17,755
Timber products output from roundwood	do	7,046	8,246	9,748	10,749	13,874	16,176
Timber cut:							
Growing stock	do	7,244	8,299	9,453	10,213	12,890	15,133
Live sawtimber	do	6,417	7,254	8,256	8,869	11,185	13,047
	Board-feet	35,951	40,517	47,277	49,335	68,185	79,200
Fuelwood: [3]							
Domestic consumption or demand	Standard cords	31.1	18.0	18.0	15.0	15.0	15.0
Timber products output from roundwood	do	6.2	2.3	2.3	2.0	2.0	2.0
Timber cut:							
Growing stock	Cubic feet roundwood	243	104	104	95	95	95
Live sawtimber	do	144	68	68	47	47	47
	Board-feet	595	343	343	225	225	225
All timber products:							
Domestic consumption or demand	Cubic feet roundwood	8,634	9,915	11,417	12,482	15,607	17,909
Timber products output from roundwood	do	7,522	8,426	9,928	10,903	14,028	16,330
Timber cut:							
Growing stock	do	7,487	8,403	9,557	10,308	12,985	15,228
Live sawtimber	do	6,561	7,322	8,324	8,916	11,232	13,094
	Board-feet	36,546	40,860	47,620	49,560	68,410	79,425
HARDWOODS							
All industrial wood:							
Domestic consumption or demand	Cubic feet roundwood	2,108	3,638	4,151	5,079	6,467	7,945
Timber products output from roundwood	do	2,044	3,466	3,979	4,871	6,259	7,737
Timber cut:							
Growing stock	do	2,509	3,629	4,042	5,118	6,497	7,911
Live sawtimber	do	2,113	2,818	3,126	3,809	4,819	5,749
	Board-feet	10,643	14,305	16,985	18,998	26,220	31,078
Fuelwood: [3]							
Domestic consumption or demand	Standard cords	27.5	16.0	16.0	10.0	10.0	10.0
Timber products output from roundwood	do	21.0	8.8	8.8	5.0	5.0	5.0
Timber cut:							
Growing stock	Cubic feet roundwood	761	395	395	231	231	231
Live sawtimber	do	394	193	193	106	106	106
	Board-feet	1,651	825	825	450	450	450
All timber products:							
Domestic consumption or demand	Cubic feet roundwood	3,640	4,276	4,789	5,444	6,832	8,310
Timber products output from roundwood	do	3,576	4,104	4,617	5,236	6,624	8,102
Timber cut:							
Growing stock	do	3,270	4,024	4,437	5,349	6,728	8,142
Live sawtimber	do	2,507	3,011	3,319	3,915	4,925	5,855
	Board-feet	12,294	15,130	17,810	19,448	26,670	31,528
ALL SPECIES							
All industrial wood:							
Domestic consumption or demand	Cubic feet roundwood	[4] 10,266	[5] 13,373	[5] 15,388	[6] 17,407	[6] 21,920	[6] 25,700
Timber products output from roundwood	do	9,090	11,712	13,727	15,620	20,133	23,913
Timber cut:							
Growing stock	do	9,753	11,928	13,495	15,331	19,387	23,044
Live sawtimber	do	8,530	10,072	11,382	12,678	16,004	18,796
	Board-feet	46,594	54,822	64,262	68,333	94,405	110,278
Fuelwood: [3]							
Domestic consumption or demand	Standard cords	58.6	34.0	34.0	25.0	25.0	25.0
Timber products output from roundwood	do	27.2	11.1	11.1	7.0	7.0	7.0
Timber cut:							
Growing stock	Cubic feet roundwood	1,004	499	499	326	326	326
Live sawtimber	do	538	261	261	153	153	153
	Board-feet	2,246	1,168	1,168	675	675	675
All timber products:							
Domestic consumption or demand	Cubic feet roundwood	[4] 12,274	[5] 14,191	[5] 16,206	[6] 17,926	[6] 22,439	[6] 26,219
Timber products output from roundwood	do	11,098	12,530	14,545	16,139	20,652	24,432
Timber cut:							
Growing stock	do	10,757	12,427	13,994	15,657	19,713	23,370
Live sawtimber	do	9,068	10,333	11,643	12,831	16,157	18,949
	Board-feet	48,840	55,990	65,430	69,008	95,080	110,953

[1] See section on Future Demand For Timber for basic assumptions governing lower, medium, and upper projections of demand, 1975 and 2000.

[2] Cubic feet excluding bark; standard cords (128 cubic feet) including bark; board-feet log scale, International ¼-inch rule. Domestic consumption or demand include the cubic-foot roundwood equivalent of net imports of lumber, pulpwood, woodpulp and paper, veneer logs and bolts, and veneer and veneer products. Timber products output from roundwood is expressed in cubic feet for all industrial wood and for all products combined, and in standard cords for fuelwood which is exclusive of the volume derived from slabs, edgings, veneer cores, and other plant residues; such plant residue material is accounted for in roundwood products other than fuelwood.

[3] For both domestic and industrial use.

[4] Includes 1,176 million cubic feet representing 1,752 million board-feet net imports of lumber, 11.2 million cords net imports of pulpwood and pulpwood equivalent of woodpulp and paper, and 180 million board-feet net imports of veneer logs and bolts or veneer-log equivalent of veneer and veneer products.

[5] Includes 1,661 million cubic feet representing 3 billion board-feet net imports of lumber, 14 million cords net imports of pulpwood and pulpwood equivalent of woodpulp and paper, and 630 million board-feet net imports of veneer logs and bolts or veneer-log equivalent of veneer and veneer products.

[6] Includes 1,787 million cubic feet representing 3 billion board-feet net imports of lumber, 15 million cords net imports of pulpwood and pulpwood equivalent of woodpulp and paper, and 930 million board-feet net imports of veneer logs and bolts or veneer-log equivalent of veneer and veneer products.

Appendix

Definitions

DEFINITIONS[1] [2]

Acceptable plantation. A plantation that has at least the following number of planted trees per plantation acre at the end of the fifth year after planting:

	Trees
All eastern species	400
Engelmann spruce and lodgepole pine	300
Other western species	200

All timber products consumed (roundwood basis). Total volume of timber consumed in a specified period, in terms of log and bolt volume. Includes roundwood equivalent of net imports of semifinished and finished timber products—such as lumber, woodpulp, and paper.

Allowable cut. The volume of live sawtimber and growing stock that can be cut during a given period while building up or maintaining sufficient growing stock to meet specified growth levels.

All-timber volume. Net volume in cubic feet of live and salvable dead sawtimber trees and poletimber trees of commercial species, and cull trees of all species, from stump to a minimum 4.0-inch top inside bark. Includes bole only of softwoods but both bole and limbs of hardwoods to a minimum 4.0-inch diameter inside bark. Also given in standard cords.

Bureau of Land Management ownership. See *Ownership.*

Catastrophic timber mortality. The net volume removed from live sawtimber or growing stock on commercial forest land during a specified period through death from natural causes of extreme severity. The loss in volume is of sufficient quantity to cause a major dislocation of forest management and timber utilization plans for a State or region. Examples of catastrophes: An unusually severe insect attack, an extraordinary windstorm such as the New England hurricane or a holocaust such as the Tillamook burn. A catastrophe is characterized by its unpredictable nature, suddenness and concentration of occurrence, and extreme quantity of destruction. Although the loss usually is suffered in less than a year, it may extend over more than a year, as in insect attacks. Past losses are considered catastrophic if the individual occurrence resulted in an annual mortality greater than the net annual growth of the affected State or region in 1952.

[1] Assembled by John R. McGuire.

[2] Special terms used in describing the world timber situation are defined under that heading, p. 344.

Chaparral land area. Lands supporting heavily branched dwarf trees or shrubs, usually evergreen, the crown canopy of which covers more than 50 percent of the ground and whose primary value is watershed protection. The more common chaparral constituents are species of *Quercus, Cercocarpus, Garrya, Ceanothus, Arctostaphylos,* and *Adenostoma.* Types dominated by such shrubs as *Artemisia, Opuntia, Purshia, Gutierrezia,* or semidesert species are not commonly considered chaparral.

Commercial forest land area. See *Forest land area.*

Commercial species. Tree species considered in determining stocking and growing stock. Includes species presently or prospectively usable for commercial timber products; excludes so-called weed species such as sassafras, hawthorn, and ironwood.

County and municipal ownership. See *Ownership.*

Cropland. See *Land area.*

Cull trees. Live trees of sawtimber or poletimber size that are unmerchantable for saw logs now or prospectively because of defect, rot, or species.

> **Sound cull trees.** Live trees of sawtimber or poletimber size which meet regional specifications of freedom from rot, but will not make at least one merchantable saw log now or prospectively (according to regional specifications) because of roughness, poor form, or species.
>
> **Rotten cull trees.** Live trees of sawtimber or poletimber size which fail to meet regional specifications of proportion of sound volume to total volume.

Diameter classes. A classification of trees based on diameter of the bole, outside bark, measured at breast height (4½ feet above the ground). D. b. h. is the common abbreviation for "diameter at breast height." Two-inch diameter classes, of which the even inch is the approximate midpoint, are used. For example, the 6-inch class includes trees 5.0 to 6.9 inches in d. b. h., the 12-inch class includes trees 11.0 to 12.9 inches in d. b. h.

Disposable personal income. All monetary income received during a specified period by individual persons *after* payment of direct personal taxes.

Farm ownership. See *Ownership.*

Federal ownership. See *Ownership.*

Fire protection status. A classification of commercial and noncommercial forest lands requiring protection from fire, according to the degree of protection given them.

Protected.

Class 1. Protection adequate to meet the fire situation in worst years and under serious peak loads.

Class 2. Protection adequate to meet the average fire situation but failures likely in worst years and under peak loads.

Class 3. Protection adequate to meet the fire situation in easy years but failures frequent in average or worse years.

Unprotected. No protection given.

Forest industries. See *Ownership*.

Forest land area. Includes (a) lands which are at least 10-percent stocked by trees of any size and capable of producing timber or other wood products, or of exerting an influence on the climate or on the water regime; (b) land from which the trees described in (a) have been removed to less than 10-percent stocking and which have not been developed for other use; (c) afforested areas; and (d) chaparral areas. Does not include orchard land. The minimum area that qualifies as forest land is 1 acre in the East and 10 acres in the West. Roadside, streamside, and shelterbelt strips of timber, in addition to meeting the above requirements, must be at least 120 feet wide to qualify as forest land.

Commercial forest land area. Forest land which is (a) producing, or physically capable of producing, usable crops of wood, usually sawtimber, (b) economically available now or prospectively, and (c) not withdrawn from timber utilization.

Noncommercial forest land area. Forest land (a) withdrawn from timber utilization through statute, ordinance, or administrative order but which otherwise qualifies as commercial forest land, or (b) incapable of yielding usable wood products, usually sawtimber, because of adverse site, or so physically inaccessible as to be unavailable economically in the foreseeable future.

Reserved forest land area. Productive or unproductive public forest land set aside by statute, ordinance, or administrative order for parks, monuments, wilderness areas, and other special uses.

Unproductive forest land area. Forest land incapable of yielding usable wood products, usually sawtimber, because of adverse site, or so physically inaccessible as to be unavailable economically in the foreseeable future. Includes chaparral land in the West. Unproductive forest land area includes lands that are productive in grazing, watershed, recreational, and wildlife uses.

Forest type groups. A classification of forest areas based upon the predominant species composition of the present tree cover. The major forest type groups used in this Review consist of groups of local forest cover types. The forest type group names indicate the predominant species except in the redwood and western white pine type groups. Predominance is measured in terms of cubic volume in sawtimber and poletimber stands and number of trees in seedling and sapling stands. When none of the indicated species comprise 50 percent or more (20 percent or more in the redwood and western white pine type groups), the stand is typed on the basis of plurality of cubic volume or number of trees. The major forest type groups found on commercial forest land and reserved noncommercial forest land are listed below.

Major western forest type groups.

Douglas-fir. Forests in which 50 percent or more of the stand is Douglas-fir, except where redwood, sugar pine, or western white pine comprises 20 percent or more, in which case the stand would be classified as redwood or white pine type group.

Hemlock-sitka spruce. Forests in which 50 percent or more of the stand is western hemlock, Sitka spruce, or both.

Redwood. Forests in which 20 percent or more of the stand is redwood.

Ponderosa pine. Forests in which 50 percent or more of the stand is ponderosa pine, Jeffrey pine, sugar pine, limber pine, Arizona pine, Apache pine, or Chihuahua pine, singly or in combination except where western white pine or sugar pine comprises 20 percent or more, in which case the stand would be classified as white pine type group.

Western white pine. Forests in which 20 percent or more of the stand is western white pine or sugar pine.

Lodgepole pine. Forests in which 50 percent or more of the stand is lodgepole pine.

Larch. Forests in which 50 percent or more of the stand is larch except where western white pine comprises 20 percent or more, in which case the stand would be classified as white pine.

Fir-spruce. Forests in which 50 percent or more of the stand is true fir (*Abies* spp.), Engelmann spruce, Colorado blue spruce, or mountain hemlock, singly or in combination, except where western white pine comprises 20 percent or more, in which case the stand would be classified as white pine.

Pinyon pine-juniper. Forests in which 50 percent or more of the stand is pinyon pine, Digger pine, Coulter pine, juniper, or cypress, singly or in combination.

Hardwoods. Forests in which 50 percent or more of the stand is hardwood species, except where western white pine, sugar pine, or redwood comprises 20 percent or more, in

which case the stand would be classified as white pine or redwood.

Major eastern forest type groups.

White-red-jack pine. Forests in which 50 percent or more of the stand is eastern white pine, red pine, or jack pine, singly or in combination. Common associates include hemlock, aspen, birch, and maple.

Spruce-fir. Forests in which 50 percent or more of the stand is spruce or true firs, singly or in combination. Common associates include white-cedar, tamarack, maple, birch, and hemlock.

Longleaf-slash pine. Forests in which 50 percent or more of the stand is longleaf or slash pine, singly or in combination. Common associates include other southern pines, oak, and gum.

Loblolly-shortleaf pine. Forests in which 50 percent or more of the stand is loblolly pine, shortleaf pine, or other southern yellow pines (excepting longleaf or slash pine), singly or in combination. Common associates include oak, hickory, and gum.

Oak-pine. Forests in which 50 percent or more of the stand is hardwoods, usually upland oaks, but in which southern pines make up 25–49 percent of the stand. Common associates include gum, hickory, and yellow-poplar.

Oak-hickory. Forests in which 50 percent or more of the stand is upland oaks or hickory, singly or in combination, except where pines comprise 25–49 percent, in which case the stand would be classified oak-pine. Common associates include yellow-poplar, elm, maple, and black walnut.

Oak-gum-cypress. Bottom-land forests in which 50 percent or more of the stand is tupelo, blackgum, sweetgum, oaks, or southern cypress, singly or in combination, except where pines comprise 25–49 percent, in which case the stand would be classified as oak-pine. Common associates include cottonwood, willow, sycamore, beech, and maple.

Elm-ash-cottonwood. Forests in which 50 percent or more of the stand is elm, ash, or cottonwood, singly or in combination. Common associates include willow, sycamore, beech, and maple.

Maple-beech-birch. Forests in which 50 percent or more of the stand is maple, beech or yellow birch, singly or in combination. Common associates include hemlock, elm, basswood, and white pine.

Aspen-birch. Forests in which 50 percent or more of the stand is aspen, balsam poplar, paper birch, or gray birch, singly or in combination. Common associates include maple and balsam fir.

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Fuelwood (roundwood basis). All fuelwood cut directly from trees or parts of trees, including that cut from dead and cull timber as well as from growing stock.

Gross national product (GNP). The estimated total output of all goods and services during a specified period (usually one year) expressed in dollars; may be in terms of the year-to-year buying power of the dollar, or in constant dollars at their buying power as of some specified year. Gross national product in constant dollars is an index of the quantity output of all goods and services, valued at prices of the specified year.

Growing stock. Net volume in cubic feet of live sawtimber trees and live poletimber trees from stump to a minimum 4-inch top (of central stem) inside bark. The volume of this material is also measured in standard cords, outside bark.

Growth.

Net annual growth of sawtimber. The change, during a specified year, in net board-foot volume of live sawtimber resulting from natural causes exclusive of catastrophic losses.

Net annual growth of growing stock. The change during a specified year in net cubic-foot volume of growing stock resulting from natural causes exclusive of catastrophic losses. Also given in standard cords.

Ingrowth of sawtimber. The net volume of trees that reach minimum sawtimber size (eastern softwoods, 9.0 inches d. b. h.; western softwoods and all hardwoods, 11.0 inches d. b. h.) during a specified year.

Ingrowth of growing stock. The net volume of trees that reach minimum poletimber size (5.0 inches d. b. h.) during a specified year.

Gross growth. Net annual growth plus annual mortality.

Needed growth. The net annual growth, on commercial forest land, of timber that would meet a specified future level of timber demand plus a margin for catastrophic losses, new forms of wood use and losses of commercial forest land to other uses. Needed growth and timber removal are the same quantity on a national basis, but for an individual species group needed growth is the proportion of total national needed growth which can be contributed by a species group on the basis of its realizable growth.

Realizable growth.[3] The net annual growth of timber that would be attained if the better present-day forestry practice in the various

[3] In the plans and review draft, realizable growth was defined as growth that it would be practical to attain if all forest land was managed as extensively as justified under specified assumptions as to future prices and other economic conditions. However, in making estimates of realizable growth, the most practical guide available was the growth that would be attained if the better present-day forestry practices in the various regions were extended to all commercial forest land. The definition has therefore been revised to reflect procedures actually used.

regions were extended to all commercial forest land.

Growth deficiency. See *Growth impact.*

Growth impact. Mortality plus growth loss. (See section on "Forest Protection," p. 185.)

Mortality. The net board-foot volume removed from live sawtimber, or the net cubic-foot volume removed from growing stock, during a specified year through death from natural causes, exclusive of catastrophic losses.

Growth loss. Growth deficiency plus loss of accumulated growth.

Growth deficiency. Timber loss due to (a) delay in restocking or deficiencies in stocking resulting from damage by insects, disease, animals, fire, or adverse weather, and (b) the reduction in growth due to changes in timber type, defoliation, reduction of tree vigor, increase in cull percent, or deterioration of site due to such destructive agents.

Loss of accumulated growth. The effect on present and prospective yields of live sawtimber or growing stock due to mortality (caused by such agents as fire, insects, disease, animals, and adverse weather) of poletimber trees, saplings, and seedlings in the case of sawtimber yields, and saplings and seedlings in the case of growing-stock yields.

Hardwood limbs. The limbs of live sawtimber hardwood trees and sawtimber-size cull hardwood trees to a minimum diameter of 4.0 inches inside bark.

Hardwoods. In the United States and Coastal Alaska, dicotyledonous (usually broad-leaved and deciduous) trees of commercial species. See *Species groups.*

Indian ownership. See *Ownership.*

Industrial wood (roundwood basis). All wood timber products, except that portion of the fuelwood output cut directly from trees or parts of trees. Industrial-wood products in roundwood form (as saw logs, veneer logs, and bolts) do contain a certain wood volume eventually used for fuel in the shape of mill residues.

Input index. A statistical means for measuring the relative quantities of any broad class of raw materials consumed by the Nation's economy during a series of years. Conventional units of measure (such as cubic feet of timber, tons of mineral ore, bales of cotton, etc.) cannot be compared one with another nor aggregated. In constructing the input index, the consumption of each material, in its conventional unit of measure, is weighted by its national average price during a specified base period. The common unit of measure is thus the quantity of a given material, or mix of materials, that could have been purchased for one dollar in the base period. Such an index provides a rough approximation of quantity input, weighted by values as of the base period.

Labor force. That section of the population 14 years of age and older that is or could be expected to be: (a) productively engaged in civilian economic activity of all kinds, (b) serving in the Nation's armed forces, and (c) out of employment but available for and willing to accept employment.

Land area. Includes dry land and land temporarily or partially covered by water, such as marsh lands, swamps, and river flood plains (omitting tidal flats); streams, sloughs, estuaries, and canals less than one-eighth of a statute mile in width; and lakes, reservoirs, and ponds having less than 40 acres of area.

Forest land. See *Forest land area.*

Cropland in farms. Includes cropland harvested and cropland not harvested and not pastured, as defined in the 1950 Census of Agriculture as follows:

Cropland harvested. This includes land from which crops were harvested; land from which hay (including wild hay) was cut; and land in small fruits, orchards, vineyards, nurseries, and greenhouses.

Cropland not harvested and not pastured. This includes idle cropland; land in soil-improvement crops only; land on which all crops failed; land seeded in crops for harvest after 1949; and cultivated summer fallow.

Pasture and range in farms. Includes cropland used only for pasture and other pasture, as defined in the 1950 Census of Agriculture as follows:

Cropland used only for pasture. Includes rotation pasture and all other cropland that was used for pasture.

Other pasture. Includes rough and brushland pastured and any other land pastured excepting woodland and cropland.

Pasture and range not in farms. Grazed nonforest land not in farm ownership. Confined almost entirely to lands in public ownership.

Other land. This item includes all house lots, barn lots, lanes, roads, ditches, power lines, etc. It includes all nonforest land that is not included in any of the other specified land-use classes.

Log grades. Criteria for describing the relative quality of a log or for classifying a given volume of sawtimber according to the quality of its saw-log components. The log grades used in this report are those developed for (1) eastern hardwood saw logs suitable for standard lumber and (2) southern pine saw logs suitable for yard lumber.

For eastern hardwoods three standard lumber log grades are used: Grade 1 logs, studies have shown, yield about 65 to 80 percent of their volume in No. 1 Common and Better grades of lumber, Grade 2 logs yield about 40 to 64 percent, and Grade 3 logs yield only about 13 to 36 percent of No. 1 Common and Better lumber. Included with the volume of Grade 3 standard lumber logs is the volume of hardwood logs which are not suitable for standard

lumber but which can be used for ties and timbers. (See "Forest Land and Timber," table 84, p. 138). Detailed specifications for hardwood log grades are given in the following publication:

U. S. Forest Products Laboratory, *Hardwood Log Grades for Standard Lumber and How To Apply Them.* U. S. Forest Serv., Forest Prod. Lab. Rpt. D1737–A, 16 pp., illus. Madison, Wis., 1949. [Processed.]

For the southern yellow pines, four lumber grades, based on yard-lumber specifications, are used: Average Grade 1 logs, according to one recent study, yield over 50 percent B and Better lumber, Grade 2 logs 30 to 50 percent, Grade 3 logs 13 to 17 percent, and Grade 4 logs only 1 to 4 percent B and Better lumber. Grade specifications can be found in:

U. S. Forest Service. *Interim Log Grades for Southern Pine.* 18 pp., illus. 1953. [Processed.]

Logging residues.

Logging residues from live sawtimber. The net board-foot volume of live sawtimber trees cut or killed by logging and not converted to timber products.

Logging residues from growing stock. The net cubic-foot volume of live sawtimber and poletimber trees cut or killed by logging and not converted to timber products. Also given in standard cords.

Loss of accumulated growth. See *Growth impact.*

Lumber manufacturer. See *Ownership.*

Merchantable top (sawtimber trees). The point on the bole of sawtimber trees above which a minimum merchantable saw log, as defined regionally, cannot be produced.

Mortality, annual.

Annual mortality of sawtimber. The average annual net board-foot volume removed from live sawtimber during a specified period through death from natural causes, exclusive of catastrophic losses.

Annual mortality of growing stock. The average annual net cubic-foot volume removed from growing stock during a specified period through death from natural causes, exclusive of catastrophic losses. Also given in standard cords.

National forest ownership. See *Ownership.*

National income. All monetary income received by individual persons during a specified period, *before* payment of direct personal taxes; plus all undistributed corporate earnings. Does not include funds allocated to depreciation and depletion nor indirect business taxes. *Gross national product* includes national income plus these latter items.

Net volume.

Net volume in board-feet. Gross volume in terms of the International ¼-inch log rule, less deductions for rot, sweep, and other defects affecting use for lumber.

Net volume in cubic feet. Gross volume in cubic feet less deductions for rot. Also reported in standard cords of 128 cubic feet, including bark.

Noncommercial forest land area. See *Forest land area.*

Nonforest land area. Land that does not qualify as forest land. The minimum area recognized as nonforest land is 1 acre in the East and 10 acres in the West. Includes unimproved roads, streams, canals, rights-of-way, clearings, and treeless strips less than 120 feet wide. Improved roads, regardless of width, will be classified as nonforest land. Includes land that has never supported forest growth; land that is less than 10 percent stocked with forest trees and that has been developed for other use, such as grazing, agricultural, residential, or industrial; all land in thickly populated urban and suburban areas; and water classified by the Bureau of the Census as land. See *Land area* and *Forest land area.*

Nonstocked area. See *Stocking.*

Old-growth sawtimber stands. Sawtimber stands in which over 50 percent of the net board-foot volume is in old-growth sawtimber trees.

Operating area. (1) The operating area of an individual ownership is the combined area of the forest types, within the ownership, in which some cutting was done between January 1, 1947, and date of examination, 1952–1954. (2) The operating area of any size class or type of ownership is the sum of the operating areas on individual ownerships in that size class or type of ownership. See the section Method of Expressing Results, p. 234, for further explanation.

Other Federal ownership. See *Ownership.*

Other private ownership. See *Ownership.*

Other wood manufacturer. See *Ownership.*

Owner. The person or group of persons in whom is vested the title of a particular property.

Ownership. The property owned by one owner, regardless of the number of parcels that it may consist of, in a specified area such as a State, region, or section, or in the United States and Coastal Alaska as a whole.

Ownership classes. A classification of property based on the following types of ownership:

Federal ownership or trusteeship. Property owned or administered by the Federal Government. Includes the following types of ownership:

National forest. Federal property which, by executive order or statute, has been designated as a national forest, purchase unit, or experimental area or Federal property administered in conjunction with the national forests.

Indian. Indian tribal property or trust allotments, i. e., real estate held in fee by

the Federal Government but administered and managed for Indian tribal groups, or allotted in trust to individual Indians.

Bureau of Land Management. Federal property administered by the Bureau of Land Management in the U. S. Department of the Interior.

Other Federal. Other property owned or administered by the Federal Government.

State ownership. Property in State ownership or under lease to a State for 50 years or more.

County and municipal ownership. Property in county, municipal, or other local public ownership.

Private ownership. Property in one of the following types of private ownership:

Farm. Land in farms as defined by the Census of Agriculture, with these exceptions: (a) Indian reservation farms (classified as land in Federal ownership or trusteeship), (b) public institutional, experiment station, and other public land in farms (classified as land in specified public ownership), (c) certain large acreages of grazing lands in the West, leased from railroads or other nonfarmers without transfer of timber cutting rights to the lessee (classified as land in forest industry or other private ownership).

In the 1950 Census of Agriculture, a farm was a place of three or more acres producing agricultural products in 1949, exclusive of home gardens, valued at $150 or more. The agricultural products could have been either for home use or for sale. Places of less than three acres were counted as farms only if the value of sales of agricultural products in 1949 was $150 or more. Places operated in 1949 for which the value of agricultural products in 1949 was less than these minima because of crop failure or other unusual situation, and places operated in 1950 for the first time, were counted as farms if normally they could be expected to produce these minimum quantities of farm products. All the land under the control of one person or partnership, through ownership, lease, rental, or cropping arrangement, was included as one farm ownership. Commercial forest land in farms is not the same as woodland in farms as reported by the Census. Part of the difference is due to the exceptions to land in farms, stated above. However, the major part of the difference arises because some of the woodland in farms is noncommercial forest land. In some cases, lands that qualify as commercial forest land were classed as pasture or waste lands by the Census.

Forest industries. Property of forest owners who operate primary wood-processing plants and who apparently obtain more of their income from the sale of wood products than from any other single source, or who operate wood-processing subsidiary corporations that derive income chiefly from the sale of wood products. Includes industries comprised of the following kinds of manufacturers:

Lumber manufacturer. A forest owner who manufactures lumber and who uses a greater cubic volume of timber from his land for this purpose than in any other type of primary wood-processing plant that he may operate.

Pulp manufacturer. A forest owner who manufactures pulp and who uses a greater cubic volume of timber from his land for this purpose than in any other type of primary wood-processing plant that he may operate.

Other wood manufacturer. A forest owner who manufactures veneer, cooperage, or other wood products except pulp and lumber.

Other private ownership. Private property, other than that classified as farm or forest industry ownership, such as property owned by business and professional persons, wage earners, housewives, retired persons, nonforest industries, estates, and dealers in forest land.

Ownership size classes. A classification of private commercial forest land based on the acreage of commercial forest land in an ownership, regardless of the number of tracts that comprise it.

Small. An ownership of less than 5,000 acres of commercial forest land. Ownerships of less than 3 acres in the East and of less than 10 acres in the West were not enumerated, nor was the productivity of their cutover lands determined, though their acreage is included in the commercial forest area of small ownerships.

Medium. An ownership of 5,000 to 50,000 acres of commercial forest land.

Large. An ownership of 50,000 or more acres of commercial forest land.

Physical-structure raw materials. All the raw materials not used as food or as a source of heat, light, and mechanical energy. The physical-structure materials include: (a) all metals except gold and those used in production of atomic energy, (b) all the nonmetallic-nonfuel minerals, (c) all the fibers, (d) all the plastics, and (e) all timber products except fuelwood. The physical-structure materials provide the substance of the things we make and use.

Plant residues. Slabs, edgings, trimmings, miscuts, cull pieces, veneer cores, sawdust, shavings, wood substance lost in barking, shipper rejects and screenings at pulp mills, veneer clippings and other residues developed from logs, bolts, and other round timber in the primary manufacturing process, excluding lignin and various dissolved wood substances incurred in pulp manufacture.

Plantable area. Nonstocked or poorly stocked forest land or nonforest land on which: (a) the establishment of forest tree cover is desirable and practical, and (b) regeneration will not occur naturally within a reasonable time. As judged by 1952 conditions, plantable area includes virtually all of the nonstocked forest land. It also includes certain areas of seedlings and saplings slightly in excess of 10-percent stocked where local experience and judgment indicated that the areas were practical to plant. The nonforest category generally pertains to former timberland diverted to cropland but now lying idle. "A reasonable time" means that poorly stocked seedling and sapling areas in the eastern types and coastal conifer types in the West should not be left understocked for more than 5 years and interior western types for more than 10 years.

Planting. The establishment of tree cover (tree or shrub cover in shelterbelts) by planting of nursery stock or by direct seeding.

Planting success. The area of acceptable plantations divided by the total area planted.

Poletimber stands. See *Stand size class.*

Poletimber trees. See *Tree size class.*

Poorly stocked stands. See *Stocking.*

Projected demand for timber. The estimated quantity of a timber product or products, or of timber, that presumably would be demanded by the Nation's economy at specified times in the future; under conditions set forth in explicit assumptions as to: (a) growth of the economy, (b) technological trend in use of materials and of substitutions, and (c) relationship of timber-product prices to prices of competing materials.

Productive but reserved forest land area. See *Forest land area.*

Productivity of recently cut lands. A concept used to evaluate the conditions affecting present and prospective timber growth, on lands logged for commercial timber products between January 1, 1947, and date of examination, 1952–54, in relation to standards of stocking, species composition, and felling age adjudged currently attainable and practical under local conditions. Full explanation is given in the section Productivity of Recently Cut Lands, p. 223.

Pulp manufacturer. See *Ownership.*

Realizable growth. See *Growth.*

Recently cut lands. See *Operating area* and *Productivity of recently cut lands.*

Reserved forest land area. See *Forest land area.*

Rotten cull trees. See *Cull trees.*

Roundwood. The cubic volume of logs, bolts, and other round sections as they are cut from the tree.

Salvable dead trees. Standing or down dead trees which are considered merchantable by regional standards.

Sampling error. The error of an estimated total or average that arises from taking a sample rather than making a complete inventory or measurement. In this Review, sampling errors do not include bias due to errors in photo classification of areas, mapping, measuring volume, tabulation, computation, and compilation; these processes could give rise to error whether or not sampling is used.

Saw-log portion. The portion of sawtimber trees between stump and merchantable top.

Sawtimber stands. See *Stand size class.*

Sawtimber trees. See *Tree size class.*

Sawtimber volume.

Live sawtimber volume. Net volume in board-feet, International ¼-inch rule, of live sawtimber trees of commercial species.

Salvable dead sawtimber volume. Net volume in board-feet, International ¼-inch rule, of salvable dead sawtimber trees of commercial species.

Seedling and sapling stands. See *Stand size class.*

Seedlings and saplings. See *Tree size class.*

Shelterbelt. A plantation of trees or shrubs established to serve as a windbreak to prevent wind erosion, protect farm buildings, and otherwise moderate the microclimate.

Softwoods. In the United States and Coastal Alaska, coniferous, evergreen (except larches and baldcypress) trees of commercial species. See *Species groups.*

Sound cull trees. See *Cull trees.*

Species groups.

Eastern softwoods.

Longleaf and slash pines	Spruce and balsam fir
Shortleaf and loblolly pines	White and red pines
Other southern yellow pines	Jack pine
	Hemlock
	Cypress
Other eastern softwoods	

Eastern hard hardwoods. Hardwood species whose wood has an average hardness index value of more than 80 as listed in table 1 of L. J. Markwardt's *Comparative Strength Properties of Woods Grown in the United States*, U. S. Dept. Agr. Tech. Bul. 158, 38 pp. 1930. Included are:

White oaks (*Quercus alba* and *Q. prinus*)	Yellow birch
Other white oaks	Sugar maple
Red oaks (*Q. borealis* and *Q. falcata* var. *pagodaefolia*)	Beech
Other red oaks	Ash
	Hickory
	Black walnut
	Other hard hardwoods

Eastern soft hardwoods. Hardwood species whose wood has an average hardness index value of 80 or less as listed in table 1 of L. J. Mark-

wardt's *Comparative Strength Properties of Woods Grown in the United States*, fully identified above. Included are:

Soft maple	Cottonwood and aspen
Sweetgum	Basswood
Tupelo and blackgum	Yellow-poplar
Other soft hardwoods	

Western softwoods.

Douglas-fir	Sitka spruce
Ponderosa and Jeffrey pines	Engelmann and other spruces
True firs	Western larch
Western hemlock	Western redcedar
Sugar pine	California incense-cedar
Western white pine	Lodgepole pine
Redwood	Other western softwoods

Western hardwoods.

Aspen	Red alder
Other western hardwoods	

Stand improvement measures. Measures, such as pruning, release cutting, girdling, weeding, or poisoning of cull trees, applied with purposeful intent to improve growing conditions in either natural or planted stands, and not with the intent of producing commercial timber products.

Stand size class.

Sawtimber stands. Stands of sawtimber trees having a minimum net volume per acre of 1,500 board-feet, International ¼-inch rule, except in softwood types in the Douglas-fir subregion of the Pacific Northwest and in California west of the Sierras, where the minimum net volume per acre is 4,000 board-feet, International ¼-inch rule.

Poletimber stands. Stands failing to meet the sawtimber stand specifications, but at least 10-percent stocked with poletimber and larger trees and with at least half this minimum stocking in poletimber trees.

Seedling and sapling stands. Stands not qualifying as sawtimber or poletimber stands, but at least 10-percent stocked with trees and with at least half this minimum stocking in seedlings or saplings.

Nonstocked and other areas. Areas not qualifying as sawtimber, poletimber, or seedling and sapling stands.

Standard error. The range about a sample-estimated average or total, within which the odds are 2 to 1 that the average or total based on complete coverage (100-percent sample) would fall.

State ownership. See *Ownership*.

Stocking. Stocking is the extent to which growing space is effectively utilized by present or potential growing-stock trees of commercial species. Degree of stocking is synonymous with "percent of growing space occupied" and means the ratio of actual stocking to full stocking for comparable sites and stands. Stocking may be measured in terms of number of trees, volume, basal area, cover canopy, or other criterion, or combination of criteria.

Nonstocked areas. Areas that are 0- to 10-percent stocked with present or potential growing-stock trees.

Poorly stocked stands. Stands that are 10- to 39-percent stocked with present or potential growing-stock trees.

Well- and medium-stocked stands. Stands that are 40-percent or more stocked with present or potential growing-stock trees.

Timber-connected economic activity. The estimated man-years of employment, wages and salaries paid, and national income, directly associated with the growing and protection of the timber resource; and with the harvesting, processing, fabrication, transportation, and distribution of timber products.

Timber cut.

Timber cut from live sawtimber. The net board-foot volume of live sawtimber trees cut or killed by logging during a specified year.

Timber cut from growing stock. The net cubic-foot volume of live sawtimber and poletimber trees cut or killed by logging during a specified year. Also given in standard cords.

Timber products output. The volume of timber products cut from growing stock on commercial forest land and from other sources such as cull trees, salvable dead trees, limbs, saplings, material less than 4 inches in diameter, timber on noncommercial and nonforest lands, and plant residues. Timber products include saw logs, veneer logs and bolts, cooperage logs and bolts, pulpwood, fuelwood, piling, poles, posts, hewn ties, mine timbers, and various other round, split, or hewn products.

Timber removal. The volume of growing stock and live sawtimber which would be cut to supply projected demands for timber products plus an allowance for removals of inventory due to unanticipated new uses for wood, catastrophic events, and conversion of commercial forest land to other uses. Timber removal on a national basis is the same as needed growth, but for an individual species group is the proportion of total national removal of timber which can be contributed annually with least impairment of prospects for future growth.

Tract. A single parcel of land that is not contiguous to any other parcel in the same ownership, and that includes one or more areas of commercial forest land.

Tree size class. Any one of the following tree classes in which the trees are grouped chiefly according to diameter at breast height, outside bark:

Sawtimber trees. Trees of commercial species that contain at least one merchantable saw log as defined by regional practice and

which are of the following minimum diameters at breast height:

Eastern regions:	Softwoods 9.0 inches
	Hardwoods 11.0 inches.
Western regions:	All species 11.0 inches.

Poletimber trees. Trees of commercial species which meet regional specifications of soundness and form, and which are of the following diameters at breast height:

Eastern regions:	Softwoods 5.0 to 9.0 inches
	Hardwoods 5.0 to 11.0 inches.
Western regions:	All species 5.0 to 11.0 inches.

Seedling and sapling trees. Live trees of commercial species, less than 5.0 inches in diameter at breast height, and of good form and vigor.

Unproductive forest land area. See *Forest land area.*

Upper stem portion (sawtimber trees). The portion of sawtimber trees between merchantable top and a point on the bole with a minimum top 4.0 inches in diameter inside bark when it exists.

Well- and medium-stocked stands. See *Stocking.*

Young-growth sawtimber stands. Sawtimber stands in which 50 percent or more of the net board-foot volume is in young-growth sawtimber trees.

Appendix

Converting Factors

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CONTENTS

CONVERTING FACTORS

George F. Burks

In dealing with timber volume or volume of different timber products, three types of converting factors are commonly used: (1) Forest resource factors to convert inventory volume from one unit of measurement to another such as board-feet to cubic feet, and cubic feet to cords; (2) roundwood factors to convert board-foot volumes of logs and bolts measured by a given log rule to equivalent volume by another, or to convert quantity units such as pieces to cubic feet, excluding bark, cords, or board-feet; and (3) utilization factors to show volume of growing stock (live sawtimber and poletimber trees) cut per unit of output of various timber products.

The three sets of converting factors presented here are applicable on a sectional or broad regional basis and denote average relationships derived from the factors in use in different parts of the country.

FOREST RESOURCE FACTORS

Forest resource factors compare (a) inventory volume in board-feet by the International ¼-inch log rule for sawtimber trees with the corresponding cubic-foot volume, less bark, including both the saw-log and upper-stem portions, and (b) the cubic foot-cord relationships applicable to total growing stock consisting of live sawtimber and poletimber trees.

Sawtimber

	Cubic feet per M board-feet International ¼-inch log rule		
	All species	*Softwood*	*Hardwood*
North	219	241	213
South	205	195	216
West	171	170	219
Continental United States	184	176	215

Growing Stock

	Cubic feet per cord		
	All species	*Softwood*	*Hardwood*
North	76	79	75
South	71	74	69
Average East	73	75	72

ROUNDWOOD FACTORS

Roundwood factors compare the various round timber products in units of measure as customarily reported by the Bureau of the Census, the trade, and other sources with the corresponding roundwood volumes of the logs or bolts from which the product came, expressed in (a) board-feet International ¼-inch log scale, (b) cubic feet excluding bark, and (c) standard cords (128 cubic feet) including bark. They apply to all logs and bolts used for particular products whether the trees from which they were cut were live or dead, classed as culls, or from commercial forest, noncommercial forest, or nonforest land.

All the various products, except hewn ties, are originally reported as either logs, bolts, cordwood, or other round timber, but their volume is given in different units of measure. Thus appropriate converting factors are needed to translate these various volumes in common units to standard units of measure so that any one may be properly compared with any other, or that all may be combined and treated as a group. Saw logs for lumber, for example, are commonly reported in board-feet lumber tally, whereas veneer logs and bolts and cooperage logs and bolts are reported in board-feet log scale according to various log rules—Doyle, Scribner, Spaulding—depending on local practice. Pulpwood and fuelwood statistics commonly are reported in standard rough cords (128 cubic feet), poles, posts, and hewn ties in number of pieces, piling in linear feet, and mine timbers and miscellaneous round timbers in cubic feet.

Saw Logs, Veneer Logs and Bolts, and Cooperage Logs and Bolts

	Board-feet International ¼-inch log rule per M board-feet lumber tally		
	All species	*Softwood*	*Hardwood*
Saw logs:			
North	937	927	943
South	994	984	1, 014
West	967	968	872
Continental United States	973	970	983

	Board-feet International ¼-inch log rule per M board-feet local log rule [1]		
	All species	Softwood	Hardwood
Veneer logs and bolts:			
North	1, 077	1, 076	1, 077
South	1, 293	1, 294	1, 293
West	1, 048	1, 048	-----
Continental United States	1, 122	1, 054	1, 238
Cooperage logs and bolts:			
North	1, 174	1, 000	1, 200
South	1, 412	1, 409	1, 414
West	1, 052	1, 052	-----
Continental United States	1, 314	1, 301	1, 320

[1] Local log rule: North and South principally Doyle; West mostly Scribner.

	Cubic feet per M board-feet lumber tally		
	All species	Softwood	Hardwood
Saw logs:			
North	155	169	149
South	162	164	156
West	151	151	141
Continental United States	156	156	153

	Cubic feet per M board-feet local log rule [1]		
	All species	Softwood	Hardwood
Veneer logs and bolts:			
North	165	171	165
South	196	199	196
West	159	159	---
Continental United States	170	160	188
Cooperage logs and bolts:			
North	185	235	178
South	220	235	209
West	159	159	---
Continental United States	205	224	195

[1] Local log rule; North and South principally Doyle; West mostly Scribner.

	Cubic feet per M board-feet International ¼-inch log rule		
	All species	Softwood	Hardwood
Saw logs:			
North	166	182	158
South	163	167	154
West	156	156	162
Continental United States	160	161	156
Veneer logs and bolts:			
North	153	159	153
South	152	154	152
West	152	152	---
Continental United States	152	152	152
Cooperage logs and bolts:			
North	158	235	148
South	156	167	148
West	151	151	---
Continental United States	156	172	148

Pulpwood and Fuelwood

	Cubic feet per cord		
	All species	Softwood	Hardwood
Pulpwood:			
North	78	79	74
South	73	72	79
West	90	90	90
Continental United States	77	77	77
Fuelwood:			
North	69	67	69
South	77	77	77
West	84	86	73
Continental United States	75	78	73

	Board-feet International ¼-inch rule per cord [1]		
	All species	Softwood	Hardwood
Pulpwood:			
North	150	200	100
South	147	145	163
West	488	488	393
Continental United States	204	217	128
Fuelwood:			
North	110	95	110
South	179	157	188
West	414	426	273
Continental United States	163	177	159

[1] A cord of pulpwood and fuelwood ordinarily contains material from both sawtimber and poletimber trees. These factors show the board-foot volume, according to inventory standards, of the sawtimber material in the average cord.

Poles and Piling

	Cubic feet per piece		
	All species	Softwood	Hardwood
Poles:			
North	8. 3	8. 3	4. 0
South	12. 5	12. 5	11. 8
West	18. 6	18. 6	----
Continental United States	13. 5	13. 6	11. 1

	Board-feet International ¼-inch log rule per piece		
	All species	Softwood	Hardwood
Poles:			
North	26. 0	26. 0	-------
South	66. 0	66. 0	-------
West	88. 0	88. 0	-------
Continental United States	69. 0	69. 0	-------

	Cubic feet per linear foot		
	All species	Softwood	Hardwood
Piling:			
North	0. 63	0. 63	0. 62
South	. 68	. 68	. 69
West	. 75	. 75	. 62
Continental United States	. 68	. 69	. 62

	Board-feet International ¼-inch log rule per linear foot		
	All species	Softwood	Hardwood
Piling:			
North	3. 14	3. 06	3. 26
South	3. 58	3. 58	3. 34
West	4. 66	4. 66	----
Continental United States	3. 67	3. 70	3. 26

Posts and Hewn Ties

	Cubic feet per piece		
	All species	Softwood	Hardwood
Posts:			
North	0. 59	0. 62	0. 59
South	. 64	. 63	. 65
West	. 98	. 98	. 99
Continental United States	. 63	. 67	. 62
Hewn ties: [1]			
North	4. 99	----	4. 99
South	6. 66	6. 26	6. 90
West	----	----	----
Continental United States	6. 62	6. 25	6. 83

[1] The average hewn tie contains about 3.22 cubic feet and 38.6 board-feet. A log or bolt to produce the final product contains, on the average, approximately double this volume in cubic feet but roughly the same volume in board-feet log scale.

Mine Timbers and Miscellaneous

	Board-feet International ¼-inch rule per cubic foot		
	All species	Softwood	Hardwood
Round mine timbers:			
North	1. 15	2. 80	1. 01
South	1. 22	1. 36	1. 15
West	2. 77	2. 77	----
Continental United States	1. 35	2. 43	1. 04
Miscellaneous:			
North	3. 08	2. 74	3. 11
South	3. 05	1. 58	3. 72
West	5. 12	5. 12	----
Continental United States	3. 57	3. 70	3. 48

UTILIZATION FACTORS

Utilization factors show the volume of growing stock (live sawtimber and poletimber trees) cut per unit of output of various timber products (table 82). They show, for example, how much sawtimber is cut per M board-feet of lumber and the volume of growing stock cut per cord of pulpwood, including pulpwood from both round timber and plant residues.

Utilization factors are computed for 1952 on the basis of inventory standards and utilization practices prevailing in that year. Their principal function is to provide a basis, until significant changes in utilization practices occur, for estimating the cut of live sawtimber and growing stock associated with a given volume of output of timber products.

Average utilization factors for each product were estimated also for 1975 on the basis of 1952 inventory standards and future utilization practices indicated by probable future trends in the various regions. They appear in the section "Future Demand for Timber," page 468, as indexes showing deviations from 1952. The indexes were used to translate projected levels of demand for timber products in 1975 to timber cut from domestic forests.

Part of the growing stock that is cut for timber products is not being used. Varying amounts are left as residues depending on the product. The growing stock inventory consists of the net volume of sound material in live sawtimber and poletimber trees measured in board-feet International 1/4-inch log scale for the saw-log portion of sawtimber trees, and in cubic feet for entire trees to a minimum top of 4 inches d. i. b. The saw-log portion corresponds to top merchantability limits and quality standards consistent with defined utilization practices in various regions.

In terms of inventory standards there is underutilization if any sound merchantable material classed as growing stock is left unused, whether felled purposely or knocked down or killed in logging. There are also instances of overutilization of growing stock, both in board-feet and cubic feet. For example, parts of the stem above the recognized saw-log portion may be cut for lumber and thus represent overutilization in board-feet. In this instance all the material utilized is charged as timber cut in cubic feet, but only the volume represented by the saw-log portion is charged as timber cut in board-feet. Likewise pulpwood cutting might extend above the minimum 4-inch top in which case overutilization in cubic feet results. The excess in this instance is not levied against growing stock but shows up as being production from other sources.

In all regions there is both under- and overutilization because of the varying practices of logging operators. The practice of overutilization of growing stock is more prevalent in the North and South than in the West since the volume would need to be much more substantial to offset the presently large volumes of residues developed from logging in these areas.

The fact that less than a thousand feet of sawtimber on the average is required for a thousand feet of lumber simply means, for one thing, that some production comes from material below minimum size and quality, by inventory standards, in sawtimber trees and from sources other than growing stock, such as cull and dead trees, trees from noncommercial forest and nonforest land, and that this additional output in itself may be enough to more than compensate for the volume of growing stock residues left in the woods.

There are a number of other factors that may also contribute to this favorable growing stock-output relationship. For instance, lumber tally overruns International ¼-inch log scale an average of about 3 percent. More board-feet of lumber therefore are cut from saw logs on the average than are scaled by the International log rule.

Differences (overrun) between reported lumber tally and International ¼-inch log scale are as follows:

	Percent		Percent
North	6. 7	West	3. 4
South	0. 6	All regions	2. 8

However, in the case of veneer logs and bolts and cooperage logs and bolts reported volumes according to various local log rules underrun by considerable amounts what they would be by the International ¼-inch scale.

Another reason why timber cut is less than output concerns the practice of cutting pole trees for lumber and other products generally derived from sawtimber trees. While volume cut from poletimber is credited against growing stock in cubic feet no charge is made in board-feet.

Plant residues constitute part of the output of such items as pulpwood, fuelwood, and posts. This material, which develops in the primary manufacture of lumber, veneer, and other products from logs and bolts, is counted originally as growing stock cut for these items and is, therefore, not counted again for pulpwood and other products for which it subsequently may be used. In addition, considerable quantities of dead and cull

timber are used for pulpwood and fuelwood. Thus growing stock cut for these particular products represents only a part of the total output of these products. The same is true in varying degree for practically all products because of the production that is derived from sources other than growing stock.

Because of the many variables affecting utilization and the difficulty of accurately adjusting inventory standards to conform to changing utilization practices, it can be readily appreciated that factors denoting the cut of growing stock per unit of the various timber products might logically differ from one section of the country to another.

TABLE 82.—*Volume of live sawtimber and growing stock cut per unit of timber product output, by section, continental United States, 1952* [1]

Product	Unit of output	Sawtimber				Growing stock	
		Softwood		Hardwood		Softwood	Hardwood
		Bd.-ft.[2]	*Cu. ft.*[3]	*Bd.-ft.*[2]	*Cu. ft.*[3]	*Cu. ft.*[3]	*Cu. ft.*[3]
CONTINENTAL UNITED STATES							
Saw logs	M bd.-ft. lumber tally	917	161	968	189	166	201
Veneer logs and bolts	M bd.-ft. log scale [4]	1, 018	162	1, 335	259	162	262
Cooperage logs and bolts.	do	1, 215	229	1, 571	317	245	319
Pulpwood	Standard cord	198	41	121	28	68	73
Fuelwood	do	20	5	61	14	8	28
Piling	Linear foot	3. 90	. 76	3. 43	. 72	. 79	. 73
Poles	Piece	72. 5	14. 2	68. 7	10. 7	15. 7	10. 7
Posts	do	. 67	. 14	. 73	. 14	. 48	. 40
Hewn ties	do	41. 0	8. 56	51. 1	11. 50	8. 59	11. 85
Round mine timbers	Cu. ft.[3]	2. 20	. 46	. 95	. 23	1. 02	. 93
Other	do	1. 91	. 34	2. 63	. 57	. 53	. 85
NORTH							
Saw logs	M bd.-ft. lumber tally	805	168	901	160	182	179
Veneer logs and bolts	M bd.-ft. log scale [4]	1, 144	199	1, 151	203	199	206
Cooperage logs and bolts.	do	565	142	1, 284	215	237	216
Pulpwood	Standard cord	183	41	93	22	76	78
Fuelwood	do	12	4	35	8	10	23
Piling	Linear foot	3. 24	. 70	3. 46	. 72	. 70	. 72
Poles	Piece	27. 9	6. 1	0	0	10. 0	0
Posts	do	. 41	. 11	. 55	. 12	. 43	. 36
Hewn ties	do	---	---	34. 0	6. 14	---	6. 14
Round mine timbers	Cu. ft.[3]	2. 28	. 64	. 92	. 22	. 94	. 91
Other	do	2. 40	. 54	1. 83	. 38	. 98	. 64
SOUTH							
Saw logs	M bd.-ft. lumber tally	910	174	1, 014	209	185	216
Veneer logs and bolts	M bd.-ft. log scale [4]	1, 140	248	1, 398	278	248	281
Cooperage logs and bolts.	do	1, 384	262	1, 796	397	267	400
Pulpwood	Standard cord	132	31	138	33	65	66
Fuelwood	do	39	10	82	20	18	32
Piling	Linear foot	3. 74	. 76	3. 47	. 74	. 80	. 8[illegible]
Poles	Piece	69. 0	14. 1	75. 5	11. 8	14. 7	11. 8
Posts	do	. 22	. 06	. 97	. 18	. 46	. 4[illegible]
Hewn ties	do	41. 0	8. 57	51. 9	11. 73	8. 60	12. 0[illegible]
Round mine timbers	Cu. ft.[3]	1. 41	. 31	1. 16	. 33	1. 06	1. 0[illegible]
Other	do	1. 37	. 29	3. 24	. 73	. 79	1. 0[illegible]

See footnotes at end of table.

TABLE 82.—*Volume of live sawtimber and growing stock cut per unit of timber product output, by section, continental United States, 1952* [1]—Continued

WEST

Product	Unit of output	Sawtimber				Growing stock	
		Softwood		Hardwood		Softwood	Hardwood
		Bd.-ft. [2]	*Cu. ft.* [3]	*Bd.-ft.* [2]	*Cu. ft.* [3]	*Cu. ft.* [3]	*Cu. ft.* [3]
Saw logs	M bd.-ft. lumber tally	932	153	855	148	155	148
Veneer logs and bolts	M bd.-ft. log scale [4]	1,015	160			160	
Cooperage logs and bolts.	do	972	149			149	
Pulpwood	Standard cord	406	67	581	96	69	97
Fuelwood	do	7	1	24	4	1	8
Piling	Linear foot	4.99	.83	0	0	.83	0
Poles	Piece	94.4	16.0	0	0	20.9	0
Posts	do	3.24	.56	.15	.02	.73	.03
Hewn ties	do						
Round mine timbers	Cu. ft.[3]	2.51	.44	0	0	1.05	0
Other	do	2.08	.35	5.45	1.25	.42	1.46

[1] See page 468 for average utilization factors estimated for 1975 (continental United States).
[2] International ¼-inch log scale.
[3] Excluding bark.
[4] In common use locally.

Appendix

Adequacy of Data

CONTENTS

ADEQUACY OF DATA

John R. McGuire
A. A. Hasel

The purpose of this part of the appendix is to evaluate the major items of basic data in the Timber Resource Review, indicate their reliability, and point out their limitations. The discussion generally follows the order in which the data appear in the body of the report. However, there are some exceptions. For example, growth data appear in the section Growth and Utilization, but here they are discussed in connection with the data on Forest Land and Timber. This is because growth data, like forest area and timber volume data, come from a common source—the Forest Survey—and the adequacy of growth data depends much upon the adequacy of the corresponding area and volume data.

Although procedures have an important bearing on the reliability of the data, only a brief description of them is included here. In 1952 and 1953, detailed working plans covering all phases of the Timber Resource Review were widely circulated and reviewed both in and outside the Forest Service. These plans may be consulted in Forest Service regional offices and experiment stations. In addition, some procedures are described in other sections of this report and in numerous Forest Survey publications available in many libraries.

OVERALL APPRAISAL

In general, the most reliable data are those presented as national and sectional estimates. This is because the Timber Resource Review is primarily an appraisal of the Nation's timber situation as a whole and the data collected for it are mainly in the detail needed for such a national appraisal. In every case they are believed to be adequate for this purpose. The regional estimates, on the other hand, exhibit a wider range of reliability. In one or two instances, such as the regional statistics for the Plains Region, the data may not be of sufficient reliability for a detailed regional appraisal. But they are entirely adequate for the main purpose intended here—to indicate the relative extent of regional variation in the national timber situation.

A greater attempt was made to obtain data by States than in previous national appraisals of this kind. Such data are useful to many in appraising the State situation and in indicating the place of an individual State in relation to other States and to the Nation. However, the State data, which are given mainly in the "Basic Statistics" part of this appendix, are not a primary objective of the Review, and they do not constitute a major part of the analysis. Although many of the State estimates are highly reliable, some are only indicative.

Possible Errors Are of Three Kinds

In varying degree, all of the data are subject to the possibility of error. Errors could have been introduced through mistakes in classifying, measuring, tabulating, and reporting; through faulty judgment; or through the use of sampling procedures. Errors may or may not be compensating. Except for sampling error, there is no way of measuring them, but the chances of human error were reduced as far as possible by following detailed plans, by intensive training of personnel, and by careful supervision and checking of the work. Errors in judgment were minimized by requiring some positive knowledge in support of every regional estimate. However, in some estimates, such as plantable area and growth impact, judgment is more of a factor than in others because complete quantitative information was not available.

Sampling error accounts for errors that arise from taking a sample rather than making a complete inventory or measurement; it does not include possible errors due to human mistakes or faulty judgment. The sampling error of an estimate is always given here in terms of one standard error, i. e., the range about the estimate within which the odds are 2 to 1 that the value based on 100 percent coverage would fall.

All Data Are Not Equally Reliable

Among the major groups of national estimates, some overall comparisons of reliability can be made. In general, the most reliable data are the estimates of forest land area, timber volume, and ownership of forest land. The data for foreign countries, the estimates of past trends in timber volume and growth, and the estimates of tree planting and growth impact, though adequate for this report, are considerably less reliable. Intermediate between these two groups are the data on growth and utilization, productivity of recently cut lands, and ownership of timber volume.

The estimates of future demand and supply are in a different category. Unlike current or past data, their reliability depends almost entirely on the assumptions upon which they are based. Studies of past trends help in selecting assumptions and making projections, but estimates of conditions that will not occur until 1975 or 2000 cannot be made with anywhere near the same assurance as estimates of present conditions, which can be measured. Despite this limitation, projections form an essential part of any appraisal such as this. It is believed that the assumptions chosen are reasonable ones and that the future demand, growth, and inventory data are sufficiently reliable and adequate for the purpose of this Review.

FOREST LAND, TIMBER VOLUME, AND GROWTH

The 1953 estimates of forest land area and timber volume and the 1952 estimates of net annual growth are adequate and reliable enough for describing the national timber resource situation and for making regional comparisons within the continental United States and Coastal Alaska. For State by State comparisons, many of these data are also adequate, but some are not. The comparable 1945 estimates, on the other hand, are not adequate enough for similarly detailed analysis. The estimates for Interior Alaska are also crude and should be taken as no more than indicators of the timber situation there.

The 1953 estimates of forest land area and timber volume and the 1952 estimates of timber growth were based mainly on the Forest Survey, a continuing, nationwide project of the Forest Service. Data were available from initial surveys of 484 million acres of forest land, and resurveys of 171 million acres. Most Forest Survey data are obtained from aerial photographs and from ground observations. Aerial photographs provide some of the area data, but these are always checked and amplified by ground measurement. Sample ground plots provide all of the volume estimates, such as volume by species, volume by log grade, and volume by tree size.

Growth estimates are obtained by boring sample trees, measuring radial growth for a short period of years, and determining the dimensions of the tree at the beginning of the period. The difference between past volume of the tree and present volume is periodic growth. In some regions, average annual periodic growth of a species is taken as current annual growth; in other regions, growth by species is calculated for each diameter class and applied to stand tables from which current annual growth is then calculated. The average annual volume of trees that died during the period is deducted from gross growth to arrive at a net growth estimate.[4]

Forest Survey Provided Data for 33 States

Because the Forest Survey had been completed or partially completed in 33 States, and had not been started in others, procedures for determining area, volume, and growth varied, depending upon the Forest Survey situation in each State.

Forest surveys or resurveys were complete in 23 States containing 256 million acres of commercial forest land, 52 percent of the total commercial forest area in the United States and Coastal Alaska. Where these surveys antedated 1953, adjustments were made for known changes, such as in area by land-use class or stand-size class, and new volume estimates were calculated by adding net annual growth and deducting annual cut year by year. The growth estimate used in the calculations, as well as 1952 growth, was obtained by using species growth rates determined at the time of the survey.

In ten States, the Forest Survey was incomplete. Although 87 million acres of commercial forest area had been covered, 70 million acres had not. In three of these States, the unsurveyed part was examined and classified on aerial photographs, and the ground plot data from the surveyed part was then applied to the remainder of the State on the basis of this examination. In two States, partial resurvey estimates of varying but recent data were adjusted as necessary to a common year by allowing for growth and cut; average timber volumes per acre and other relations were calculated; and the results were applied to the entire commercial forest area of the State as determined by original surveys and as adjusted for known area changes. In the other five uncompleted States, Forest Survey procedures were used in the unsurveyed parts but ground sampling was lighter than usual or was limited to sample counties.

[4] The adequacy of the mortality data is discussed under Forest Protection, p. 658.

Special Surveys Made in 15 States and Coastal Alaska

For the remaining 15 States and Coastal Alaska, little or no Forest Survey data were available. Seven of these States were covered by special surveys using regular Forest Survey procedures, but with coverage that was less intensive than usual, often being confined to sample counties. In two States, there were some basic data from surveys conducted by State agencies, and these were supplemented by using aerial photographs, public land records, or new ground plot sampling as required. The other six are Rocky Mountain States with much of their commercial forest land in national-forest holdings. Recent timber inventory data on these and on other public and private holdings provided the principal basis for the estimates, but aerial photographs were interpreted and ground plots were measured where such data were insufficient.

In Coastal Alaska, areas of forest types and stand-size classes were determined from aerial photographs covering 71 percent of the commercial forest land area. Average volumes and growth rates were obtained from a relatively light sample of ground plots and from national-forest inventory data.

Adequacy of Data Depends Chiefly on Intensity of Sampling

The sampling error of the estimate of commercial forest land in the United States and Coastal Alaska is 0.2 percent (table 83). For sawtimber volume, it is 0.8 percent, and for growing stock volume, 0.6 percent. Corresponding sampling errors for net annual growth are 3.1 percent and 2.2 percent.

For the 21 Eastern States completed by the Forest Survey, sampling errors averaged 2.2 percent per million acres of commercial forest land, compared to an accuracy goal of 3.0 percent per million acres. Sampling error of growing stock averaged 4.7 percent per billion feet compared to a goal of 5.0 percent. In the two States in the West completed by the Forest Survey, the sampling errors of commercial forest area estimates averaged 2.4 percent per million acres compared to a goal of 3.0 percent. Growing stock error was 12.9 percent compared to a goal of 10.0 percent per billion cubic feet set for these States.

For States in which Forest Survey coverage was sufficiently advanced to extend estimates to the whole State, the sampling accuracy goal varied from 3.0 to 4.5 percent per million acres of commercial forest land, and from 5.0 to 12.5 percent per billion cubic feet of growing stock. In two of these States for which sampling errors were computed, North Carolina and Virginia, the commercial forest area sampling errors averaged 4.9 percent per million acres compared to a goal of 4.5 percent; growing stock errors averaged 7.6 percent per billion feet compared to a goal of 7.5 percent.

On the basis of the above comparisons for 25 States, it is believed that sampling accuracy goals in the remaining 23 States and Coastal Alaska were likewise achieved satisfactorily, and the sampling errors are entered in table 83 on this basis. Goals for the 15 States where little or no Forest Survey data were available were generally set at 6 percent per million acres of commercial forest, and varied from 10 to 15 percent per billion cubic feet.

Estimates of the sampling errors of net annual growth were calculated for five States. For these States, the sampling error per billion cubic feet was less than half the sampling error indicated for growing stock volume. However, the sampling error goals per billion cubic feet were the same for net annual growth as for growing stock volume, and it is on this basis that sampling errors for growth are estimated for the other 43 States. While this would appear to give conservative estimates, judging from the comparison available for five States, this safety margin is adopted to make allowance for the large and usually unknown variability in the mortality component of net growth, and also for possible errors in adjusting both mortality and growth for a particular year to the trend level.

The sampling error of board-foot growth was computed by multiplying the sampling error of cubic-foot growth in a State by 1.31, this ratio being based on data from States where the sampling errors of both sawtimber and growing stock volumes were calculated.

The sampling errors of breakdowns of commercial forest area by stand-size class, stocking class, and forest type group can be approximated from the relationship shown in figure 1. The steps are: (1) Note the smallest geographic unit of which the breakdown is a part and for which the sampling error is given in table 83. (2) Compute the percentage that the breakdown contributes to the total, and read from figure 1 the corresponding factor. (3) Multiply the sampling error of the total by the factor. This product is the approximate sampling error of the breakdown. For example, the sampling error of the estimate of total commercial forest area in Missouri, 15,064 thousand acres, is 0.7 percent. Of this area, 2,033 thousand acres, or 13 percent, is classed as sawtimber. From figure 1, the multiplying factor for 13 percent of the total is 2.8. The approximate sampling error for area in sawtimber stands is therefore 2.8×0.7, or 2.0 percent.

The sampling errors of timber volume by species and tree size also can be approximated from figure 1. For example, Douglas-fir makes up 49

TABLE 83.—*Sampling error*[1] *of estimates of forest area, inventory volume, and net annual growth in the United States and Coastal Alaska, by section, region, and State*

NORTH

Region and State	Total forest land area	Commercial forest land area	Noncommercial forest land area [2]	Inventory volume [2]		Net annual growth [2]	
				Sawtimber	Growing stock	Sawtimber	Growing stock
New England:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Connecticut [3]	2.1	2.1	—	5.8	4.4	24.9	19.0
Maine [4]	1.4	1.4	14.5	3.7	2.8	21.4	16.3
Massachusetts [3]	1.7	1.7	—	6.4	3.7	22.9	14.6
New Hampshire [3]	1.0	.6	24.0	3.9	2.4	9.3	7.1
Rhode Island [3]	4.6	4.6	—	16.4	12.5	29.5	22.5
Vermont [3]	1.4	1.4	—	3.2	2.2	3.8	2.9
All States	.8	.8	11.5	2.3	1.6	10.0	7.5
Middle Atlantic:							
Delaware [4]	8.9	9.0	—	19.2	14.7	—	—
Maryland [3]	1.7	1.7	—	3.6	2.6	16.8	12.8
New Jersey [4]	4.3	4.3	—	13.5	10.3	—	—
New York [3]	1.3	.9	6.4	1.8	1.4	10.5	8.0
Pennsylvania [5]	.8	.8	31.5	2.0	1.5	11.0	8.4
West Vriginia [3]	.7	.7	—	2.7	2.0	3.3	2.5
All States	.6	.5	6.1	1.2	.9	5.1	3.7
Lake States:							
Michigan [5]	1.0	1.0	14.6	3.1	2.4	28.6	21.8
Minnesota [3]	.7	.5	8.8	1.5	1.0	11.3	8.6
Wisconsin [5]	1.1	1.1	22.0	3.4	2.6	37.3	28.5
All States	.5	.5	7.1	1.8	1.3	16.7	12.2
Central States:							
Illinois [3]	1.7	1.6	—	3.7	2.8	17.4	13.3
Indiana [3]	1.3	1.2	—	2.4	1.8	10.9	8.3
Iowa [4]	3.8	3.8	—	12.0	9.2	—	—
Kentucky [3]	.9	.9	—	2.0	1.5	30.6	23.4
Missouri [3]	.7	.7	29.3	2.6	2.0	11.9	9.1
Ohio [3]	1.1	1.0	—	2.1	1.6	10.2	7.8
All States	.5	.5	17.0	1.2	.9	12.0	8.4
Plains:							
Kansas [4]	4.6	4.6	—	20.2	15.4	—	—
Nebraska [4]	4.9	4.9	—	29.9	22.8	—	—
North Dakota [4]	9.2	9.4	—	39.3	30.0	—	—
Oklahoma (West) [4]	4.6	7.4	5.2	21.0	16.0	—	—
South Dakota (East) [4]	7.4	7.2	32.5	25.5	19.5	—	—
Texas (West) [4]	2.0	7.8	2.0	—	—	—	—
All States	1.6	2.5	1.9	11.9	8.7	45.4	30.8
All regions	.4	.3	1.7	.8	.6	6.0	4.2

SOUTH

Region and State	Total forest land area	Commercial forest land area	Noncommercial forest land area [2]	Inventory volume Sawtimber	Inventory volume Growing stock	Net annual growth Sawtimber	Net annual growth Growing stock
South Atlantic:							
North Carolina [5]	1.1	1.1	13.8	2.1	1.7	9.2	7.0
South Carolina [3]	.7	.7	—	1.6	.8	4.6	3.5
Virginia [5]	1.3	1.3	13.7	3.8	2.8	15.4	11.8
All States	.7	.6	9.5	1.5	1.1	6.2	4.8

See footnotes at end of table.

TABLE 83.—*Sampling error*[1] *of estimates of forest area, inventory volume, and net annual growth in the United States and Coastal Alaska, by section, region, and State*—Continued

SOUTH—Continued

Region and State	Total forest land area	Commercial forest land area	Noncommercial forest land area [2]	Inventory volume [2]		Net annual growth [2]	
				Sawtimber	Growing stock	Sawtimber	Growing stock
Southeast:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Alabama [3]	.3	.3		2.1	1.5	7.7	5.9
Florida [3]	.6	.4	8.0	1.7	1.7	9.4	7.2
Georgia [3]	.3	.3	33.0	1.4	1.2	6.0	4.6
Mississippi [3]	.5	.5		2.6	2.1	10.1	7.7
Tennessee [3]	.6	.4	19.7	2.3	1.7	10.9	8.3
All States	.2	.2	7.1	.9	.7	3.7	3.0
West Gulf:							
Arkansas [3]	.4	.4		2.1	1.7	10.1	7.7
Louisiana [5]	1.1	1.1	32.8	2.9	2.2	11.8	9.0
Oklahoma (East)[4]	2.7	2.6	11.6	9.8	7.5	41.9	32.0
Texas (East)[4]	1.7	1.7		4.8	3.7	18.9	14.4
All States	.6	.6	10.5	1.8	1.4	7.6	5.8
All regions	.3	.3	5.0	.8	.6	3.3	2.5

WEST

Region and State	Total forest land area	Commercial forest land area	Noncommercial forest land area [2]	Inventory volume Sawtimber [2]	Inventory volume Growing stock [2]	Net annual growth Sawtimber [2]	Net annual growth Growing stock [2]
Pacific Northwest:							
Oregon [5]	1.0	0.9	4.7	1.8	1.4	19.6	15.0
Washington [5]	1.2	1.0	4.6	2.0	1.5	20.3	15.5
All States	.8	.7	3.3	1.3	1.0	14.3	10.8
California [3]	1.2	.6	1.9	2.1	1.6	5.5	4.2
Northern Rocky Mountain:							
Idaho [5]	1.5	1.2	3.6	3.5	2.7	27.5	21.0
Montana [3]	1.2	.6	3.8	2.6	3.0	10.1	7.7
South Dakota (West)[4]	3.4	2.6	27.6	13.9	10.6		
Wyoming [4]	2.7	3.2	3.7	9.7	7.4		
All States	.9	.6	2.1	2.3	1.9	21.3	14.0
Southern Rocky Mountain:							
Arizona [4]	2.2	3.4	2.5	10.2	7.8		
Colorado [4]	1.9	2.0	2.8	6.9	5.3		
Nevada [4]	2.9	18.0	2.9				
New Mexico [4]	1.9	2.5	2.9	10.2	7.8		
Utah [4]	2.3	3.4	2.7	13.8	10.5		
All States	1.0	1.3	1.2	4.8	3.6	40.4	30.2
All regions	.5	.4	.9	1.0	.8	8.7	6.6
All sections, United States	.2	.2	.8	.7	.5	3.1	2.2
Coastal Alaska [4]	4.9	8.2	6.0	11.0	8.4		
United States and Coastal Alaska	.2	.2	.9	.8	.6	3.1	2.2

[1] Sampling error in terms of one standard error.
[2] Omitted entries indicate estimates are too crude for use on a State basis.
[3] States covered by Forest Survey since January 1, 1947.
[4] States and Coastal Alaska where little or no Forest Survey data were available. In these States either special surveys were made or Forest Survey data taken prior to January 1, 1947, were adjusted to bring the statistics up to date. A special survey was made in Coastal Alaska, using probability sampling, which permitted calculation of the sampling accuracies shown.
[5] States in which Forest Survey field work was sufficiently advanced to furnish a data base for extension to the remainder of the State.

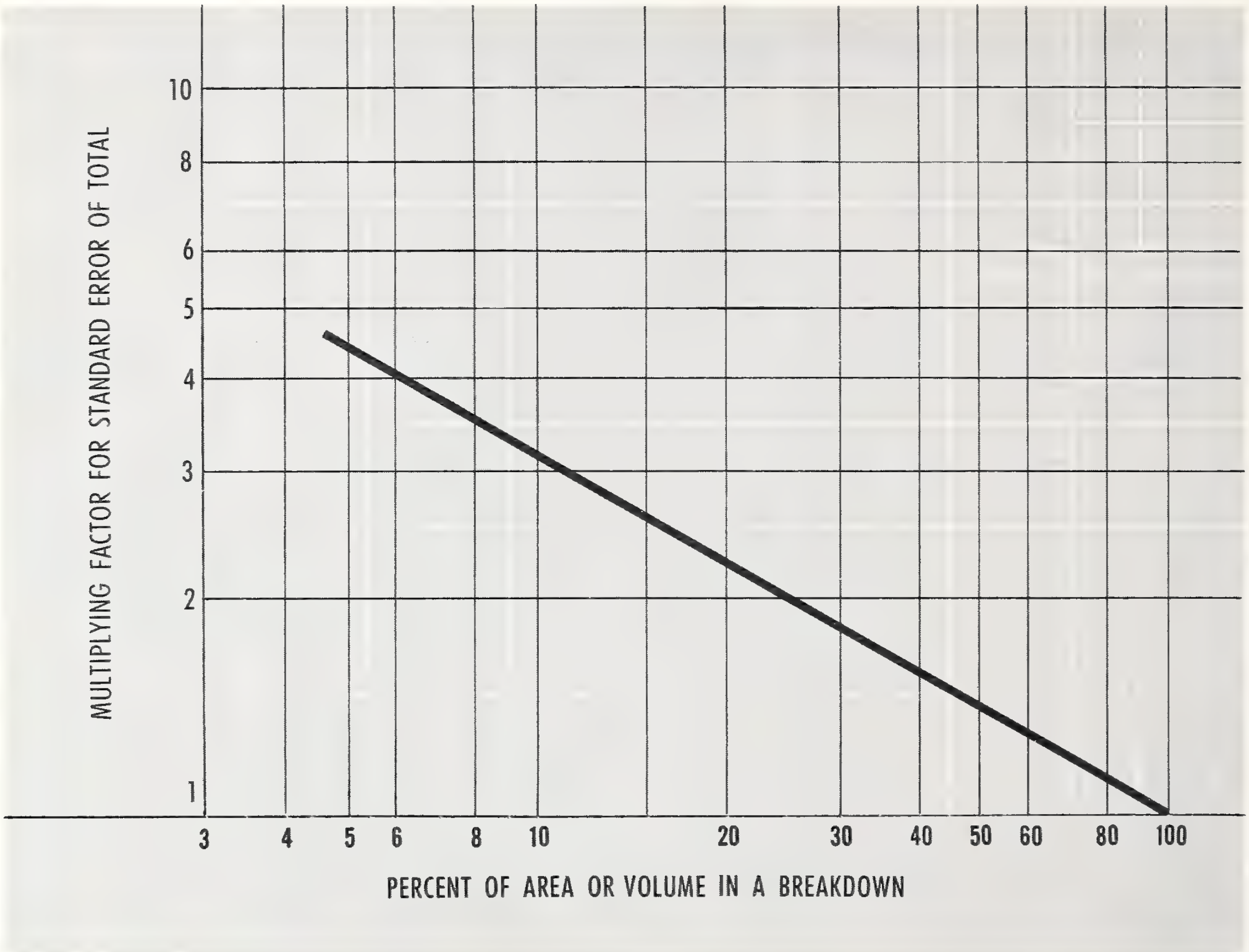

Figure 1.—Ratio of standard error of an area or volume breakdown to standard error of an area or volume total.

percent of the total sawtimber volume in the Pacific Northwest Region. The multiplying factor for 49 percent is read as 1.4. From table 83, the sampling error of the estimate of total sawtimber volume in the region is 1.3 percent. Therefore, the sampling error of the Douglas-fir volume figure is 1.3 × 1.4, or 1.8 percent.

The procedure for estimating the sampling error of breakdowns of growth is parallel to that illustrated for area and timber volume.

Nonsampling Errors Cannot Be Measured

In using Forest Survey procedures, sampling is probably the major source of error, but mistakes and errors in judgment are also possible. The magnitude of these other errors cannot be measured. However, mistakes are kept to a minimum by careful checking of photo interpretation, field work, and office compilations, and by extensive review of the resulting tabulations. Professional judgment is probably less of a factor in the Forest Survey estimates than elsewhere in the Review because Survey procedures consist largely of routine measuring with relatively few opportunities for the exercise of judgment.

The area data may suffer from misinterpretation of aerial photography, from mistakes in classifying land uses, or from failure to apply correctly the proper definitions of forest types, stand-size class, or stocking. The volume data may contain mistakes in tree measurement, misapplication of volume tables or log grades, or incorrect converting factors and cull percentages. The growth data are affected by possible mistakes in counting annual growth rings, in applying tables of average height by species, and in estimating ingrowth and mortality. Some of these errors are undoubtedly compensating but there is no way of telling how much.

One other possible source of error in the area, volume, and growth data lies in the procedures used for adjusting the data to a common date.

For the purposes of this Review, it was necessary to adjust the area and volume estimates to January 1, 1953, and the net annual growth estimates to 1952. In a few States, the Forest Survey data were assembled as early as 1947; in a few other States, part of the data was collected as late as 1954. However, most of the States were covered in between these years and nearly all of the special, less intensive surveys were made in 1952 and 1953. Where necessary, adjustments were made for known area changes; timber volumes were adjusted for growth and cutting, and known growth rates were applied to the adjusted volumes to revise the estimates of net annual growth. Usually the time period was short and the adjustments were slight. Overall, the adjustments had only minor effect upon the national totals, but in a few cases they resulted in considerable change in State figures.

Comparisons With 1945 Estimates

Indications of changes in forest area, timber volume, and growth cannot be found in comparisons of the estimates published in various reports on the timber situation in the United States. The reasons for lack of comparability are many and complex; they are discussed in the two sections Forest Land and Timber and Growth and Utilization. Yet trend information is so important that some comparisons are inevitable. In order to make the most valid comparisons possible, some adjustments were necessary.

Methods varied from region to region, depending chiefly upon the availability of recent Forest Survey data. In most cases, the use made of the original Reappraisal [5] estimates was limited to area statistics, such as area of forest types and area by stand-size classes. Where the original area estimates could not be used, known changes in commercial forest area, tree mortality rates, tree size distribution, forest type, stand size, and other factors were taken into account in making calculations from more recent surveys.

In all of the West except the Douglas-fir subregion, estimates of timber volume in 1945 were derived from 1953 data. This was also true in New England, the Middle Atlantic and Central Regions, and the northern Plains States. In the Douglas-fir subregion and in the Lake, South Atlantic, Southeastern, and West Gulf Regions, new 1945 estimates were obtained by interpolation between the original Forest Survey (made before 1945 in these regions) and resurveys.

In working back to 1945, the volume estimates were based on the assumption that 1952 rates of growth applied over the interval between 1945 and 1952, unless there was some evidence to the contrary. The estimates of timber cut used in the volume calculations were largely based on Census or other annual output statistics for the major products. Once the 1945 volumes had been recalculated, new estimates of growth were prepared by applying 1952 or interpolated growth rates by species to this volume.

The comparisons with 1945 are admittedly rough, but they are the best that can be made under the circumstances. In addition to the possibility of nonsampling errors, they also contain the sampling errors of the recent data and of earlier data. These sampling errors may be either cumulative or compensating in making the comparisons. Hence, small changes since 1945 cannot be regarded as significant.

Estimates for Interior Alaska Are Only Indicative

All of the estimates of forest land areas in Interior Alaska and of timber volumes, growth, and mortality were made by experienced Alaskan foresters. The estimates were prepared cooperatively by the Bureau of Land Management and the Forest Service. Such estimates have been prepared from time to time in the past; the present estimates represent a refinement of the older figures, and they incorporate whatever new data were at hand. Chief among the latter were the results of a special study made by H. J. Lutz, entitled Ecological Effects of Forest Fires in the Interior of Alaska, published as U. S. Department of Agriculture Technical Bulletin 1133. Although this bulletin was not published until March 1956, the data contained in it were available in advance to the technicians making the estimates for Interior Alaska.

Since no complete surveys have been made and since the growth studies available are obviously inadequate, it is not possible to attribute great reliability to the estimates here presented. They should be taken as indicative figures only.

TIMBER UTILIZATION

The estimates of timber cut in 1952 are sufficiently adequate and reliable for national and regional analysis and even for State analysis in many instances. In reliability, many of the utilization data compare favorably with the data on timber growth. The timber cut estimates depend chiefly upon timber products output or consumption [6] data which have been collected for many years by the Census or the Forest Service. These

[5] U. S. Department of Agriculture, Forest Service. *Forests and National Prosperity—A Reappraisal of the Forest Situation in the United States.* Misc. Pub. 668, 99 pp., illus. 1948.

[6] Timber products consumption data appear in the section Future Demand for Timber. They are discussed here because they are closely related to other timber utilization data, and most of them come from the same source as timber products output statistics.

data have thus been subjected to considerable checking and comparison over the years. The data for many earlier years are also considered sufficiently adequate, although the reliability of the consumption estimates probably varies appreciably from year to year, and the later timber cut estimates quoted in the timber section Growth and Utilization are undoubtedly more reliable than the earlier figures.

Logging residue and plant residue data are also discussed here. Although fewer comparisons or breakdowns can be made with these data, they are believed to be adequate for the purposes for which they are used.

Data Provided Mainly by the Census

The Bureau of the Census customarily compiles output or consumption statistics for lumber, veneer logs and bolts, and pulpwood. However, for 1952, nationwide Census data were not available when needed, and only pulpwood data were obtained solely from this source. Census estimates of 1952 lumber production were used for overall control throughout the West except that Western Pine Association data were used in computing saw-log output in part of California. In the East, Census statistics were not available in time, and saw-log output data were obtained by other means ranging from 100-percent canvasses of lumber production in some States to adjustment of prior year estimates on the basis of timber severance tax reports or limited sawmill contacts in others. For the country as a whole, these procedures resulted in an estimate of 1952 lumber production which is about 5 percent higher than the figure subsequently reported by the Census.

Output and consumption estimates for other products came from a variety of sources. For example, in the case of veneer logs and bolts, the 1952 estimates were derived mainly from Census data, but additional canvasses were made to determine the volume of logs and bolts consumed at green veneer and container veneer plants. Estimates of cooperage logs and bolts, poles and piling, round mine timbers, and hewn ties were obtained usually by mail and field canvass of producers or consumers, but, in some instances, severance tax records, public timber sale reports, or ratios based on coal production or wood preservation statistics were used. Fuelwood and fence post data came mostly from Forest Survey canvasses in sample areas. For other products, procedures varied but they were generally similar to one of those above.

For the same product, units of measure varied from place to place, and the basic data applied to different stages in the production process. In order to place all of the statistics for a given product on a standard basis, converting factors were used. These were usually developed product by product in special studies made in each region and involving a comparison of local practice with the standard units used in this report. In most regions, such studies are made as a part of the Forest Survey.

Finally, the timber cut estimates were calculated by adding to timber products output the volume of growing stock that is cut, knocked down, or killed in logging, but otherwise left unused in the woods—the logging residues. The data on logging residues were obtained from Forest Survey studies made on logging operations. Where the Forest Survey had not been made, comparable data from similar logging operations in other States were used. Saw-log and pulpwood logging residues have been studied much more intensively than residues from other kinds of logging.

Saw-Log Data Have Major Effect on Sampling Accuracy

For timber cut in 1952, the sampling accuracy goal was 12 percent per billion cubic feet. Although sampling errors could not be computed for all components, the major component is timber products output, which is estimated to have a sampling error averaging 6.5 percent per billion cubic feet. Hence, it seems safe to conclude that the sampling error of timber cut is well under the goal of 12 percent per billion cubic feet, and likely to be 8 to 9 percent.

The sampling accuracy goal for the estimate of timber products output was set at 10 percent per billion cubic feet. Since it accounted for more than half of the total output of roundwood, the saw-log estimate had a major effect on the achievement of this goal. For all regions and States for which the data provided a basis for computing sampling accuracy, the sampling errors per billion cubic feet of output are as follows:

Region or State:	*Saw logs (percent)*	*Pulpwood (percent)*	*Veneer logs and bolts (percent)*	*All other products (percent)*
New England	0.7	[1] 0	1.0	2.1
Middle Atlantic	6.5	0	0	1.4
Lake States	4.0	0	0	7.6
South Atlantic	7.4	0	.8	9.8
Florida and Georgia combined	7.6	0	1.8	10.0
California	5.8	0	.8	[2]
Montana	1.1	0	0	9.9
Idaho	.5	0	0	17.2
Weighted average	6.3	0	1.1	9.0

[1] Zero sampling error indicates 100-percent coverage.
[2] No basis for estimating sampling error.

In other States and regions, probability sampling was not employed, but the methods and intensity of coverage indicate that estimates of saw-log output are well within the sampling accuracy goal of 10 percent per billion cubic feet.

Since the bulk of timber products output was estimated with a small sampling error, a relatively large sampling error could therefore be tolerated for products other than saw logs, pulpwood, and veneer logs and bolts without exceeding the 10 percent sampling accuracy goal. Thus, it appears that the sampling error of the total 1952 estimate of timber products output in the United States and Coastal Alaska is about 2.0 percent, and the average of 6.5 percent per billion cubic feet is well within the accuracy goal. By products, the sampling errors are as follows:

	Sampling error of total estimate (percent)	*Sampling error per billion cubic feet (percent)*
Saw logs	2. 5	6. 3
Pulpwood	0	0
Veneer logs and bolts	6. 4	1. 1
Other products	5. 6	9. 0
All products	2. 0	6. 5

For saw logs and veneer logs and bolts, the sampling error per billion board-feet averages 15.8 percent—16.1 percent for saw logs alone and 2.8 percent for veneer logs and bolts.

The approximate sampling errors of other breakdowns of 1952 timber products output data can be read from figure 2. For example, the total hardwood output in the West Gulf Region is 0.5 billion cubic feet for which the figure shows a sampling error of slightly more than 9 percent. For regions or States listed in the tabulation above, figure 1 also can be used for approximating the sampling error of breakdowns in the same manner as for area, volume, and growth data.

Nonsampling Errors Are Possible

The timber utilization data are subject to errors other than those which arise from sampling. For example, mistakes may have been made because lists of timber products consumers or producers were incomplete, or because production or consumption reports obtained by mail and field canvass were in error. There may have been mistakes in selecting and applying converting factors, in

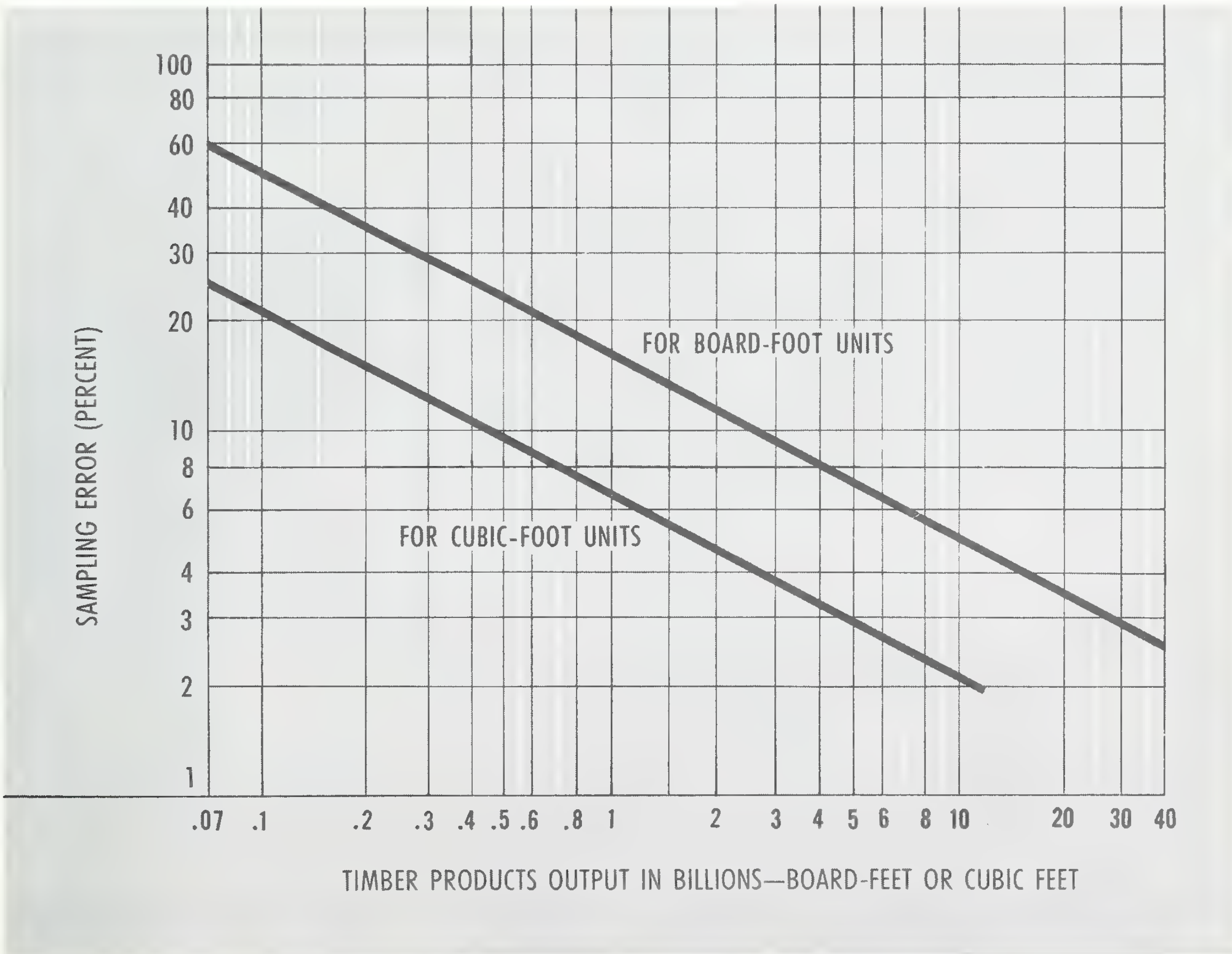

Figure 2.—Sampling error of timber products output in percent.

compiling the data and tabulating it. The logging residue data may suffer from possible mistakes such as in measuring stumps or in judging whether a cut tree was in the growing stock or cull category. In some instances, there is also the possibility of errors in judgment and other errors in adjusting timber cut data from earlier years to the 1952 base year. All of these possibilities were minimized as much as possible by careful supervision and checking of the work.

Plant Residues Data From Special Study

The plant residue estimates resulted from a study made especially for the Timber Resource Review, the first study of its kind ever made on a broad scale. The study included a mail and field canvass of sawmills and other plants. In many regions, the canvass reached all of the larger plants and only the smaller plants were sampled.

The estimates of total plant residue volumes were based, for the most part, on average ratios, between residue volume and unit of product output, applied to regional output estimates. There were several recent studies which were used to derive these output-residue ratios. Where no data had been collected in recent years, new studies were made to determine the relationships between residues and output. Plant residue use, on the other hand, was determined chiefly from reports of firms in the various forest industries.

Since the study was concerned chiefly with accurate information on the proportion of plant residue used, regional sampling accuracy goals were set on this item. This goal was 10 percent of the proportion of residues used, as determined for all plants combined in each region; it was met or exceeded in every case. Although care was taken to avoid them, nonsampling errors, such as use of improper converting factors and mistakes in reporting, may also have affected the plant residue data. In addition, any errors in the timber product output data were carried over into the plant residue calculations.

FOREST PROTECTION

It is recognized that present knowledge in a number of fields of forest protection is inadequate. Although a considerable body of data on fire losses has been accumulated, there have not been enough systematic surveys on losses caused by insects, diseases, and animals. Furthermore, the interrelationships between fire, disease, and insects are too little known. Despite these shortcomings, estimates of losses to destructive agents must be made in order to describe completely the timber situation.[7]

[7] In addition to their use in calculating growth impact, mortality data are also used for computing estimates of net annual growth.

The forest protection data on mortality, growth loss, and growth impact represent varying degrees of reliability. They are generally adequate for national and regional analysis, but some of them are insufficient for State appraisals. No sampling errors can be calculated for these data.

Fire Damage Data Most Adequate

The forest protection data were assembled and computed in various ways depending upon the type of damage. The growth impact estimates are made up of two components, mortality and growth loss. Each of these components was estimated separately and different kinds of procedures were used in each case. Information on fire damage was usually more adequate than information on other types of damage. For one thing, fire damage is more easily recognized; for another, standard fire reports and special fire damage surveys have been made for many years and in many places. At the other extreme, some insect and disease damage is difficult to recognize and isolate and there was relatively little information on hand. In these cases, average annual losses were calculated and used to represent the growth losses resulting from 1952 events.

The procedures used for estimating mortality were not new; they have been used for the Forest Survey and other forest inventories for many years. On sample plots, all dead trees were examined but only those judged to have died within a specified period of years were counted. The ratio of dead to live volume was then determined for the period and converted to an annual basis. Usually, total mortality in 1952 was taken to be the same as the average annual periodic mortality determined in this manner. The mortality data were collected along with the area, volume, and other data obtained by the Forest Survey or by supplementary surveys where Forest Survey data were not available.

With the total determined in this manner, mortality caused by fire, and to some extent by other destructive agents, was determined from records and estimates relating directly to 1952 events. For example, the size of every fire and the damage caused by it are reported for all protected areas. Many insect and disease kills in 1952 were specifically known. Surveys or estimates of these losses were usually available. Mortality due to natural suppression or to causes that operate over a period of years before killing trees were determined from annual averages.

Growth Loss Calculated in Several Ways

Growth loss data estimate the losses accumulated over time as a result of the destructive events of 1952. In effect they represent annual losses

arising from destructive events if these events were stabilized each year at the 1952 level. Thus, to the extent that 1952 was an average year for destructive events the growth losses presented are estimates of average annual losses. The two parts of growth loss, as explained in the section Forest Protection, are growth deficiency and loss of accumulated growth. Calculations of growth deficiency were made in several ways: For example, if a 1952 fire caused an estimated 5-year delay in restocking on a 500-acre recently cut area because the seed source was eliminated by the fire, and if the average per acre volume at 50-year rotation age is judged to be 20 thousand board-feet per acre, then:

$$\text{Growth loss} = \frac{\text{5-year delay}}{\text{50-year rotation}} \times 20 \text{ M bd.-ft.} \times 500 \text{ acres} = 1{,}000 \text{ M bd.-ft.}$$

Or if a 1952 defoliation due to a sawfly affected 100 acres of pine timber and 800 acres of pine plantations by reducing the growth 60 percent and 30 percent, respectively, and if the average annual growth was 60 cubic feet per acre, then:

Growth loss (timber) =
100 acres × 60 cu. ft. × 60 percent = 3, 600 cu. ft.
Growth loss (plantation) =
800 acres × 60 cu. ft. × 30 percent = 14, 400 cu. ft.

Total growth loss = 18, 000 cu. ft.

Losses due to heart rots were computed separately for merchantable and cull trees. In merchantable trees, they represent an average annual rot increment—not for the events that happened in 1952 but for the average situation found in 1952. This obviously includes an accumulation of results attributable to many previous happenings. However, this rot increment is not going to stop as long as infected sawtimber and growing stock are present. Hence, it was felt that the annual loss computed in this way comes close to approximating future annual losses. The loss due to heart rot in cull trees is equivalent to their annual gross growth because no net growth is produced on trees entirely unmerchantable.

Site deterioration also may result in growth deficiency. For example, fire may damage the soil and change the environment on 1,000 acres so that instead of a ponderosa pine forest, a stand of oak, brush, and scattered pine is likely to occupy the site. If annual growth before the fire had been 250 board-feet per acre and only 50 board-feet with the stocking and type of stand afterwards, then a growth loss of (250 board-feet—50 board-feet)×1,000 acres, or 200 thousand board-feet, occurs.

Calculation of the loss of accumulated growth was handled in the same general manner as growth deficiency. If fire killed 100 acres of 10-year-old trees below 5.0 inches in diameter, and if the average per acre yield at a rotation age of 120 years is judged to be 72 thousand board-feet, then:

$$\text{Growth loss} = \frac{\text{10 years}}{\text{120-year rotation}} \times 72 \text{ M bd.-ft.} \times 100 \text{ acres} = 600 \text{ M bd.-ft}$$

Reliability of Estimates Rests on Extensive Body of Data

The growth impact estimates are based on an extensive body of data from permanent sample plots, special surveys and research studies, Forest Survey measurements, standard fire reports, and a variety of other sources. Such records were used first and were supplemented by professional judgment only when no other basis was available. Sampling errors enter into some of these source data, but there is no way of calculating a sampling error that would apply to the total estimate of growth impact.

The most significant possibility of error lies in the exercise of professional judgment. There were numerous instances, as the above brief description of procedures shows, where such judgment had to be applied. However, the chances of error from this source were reduced as much as possible by intensive crosschecking and widespread review and by limiting the use of judgment to those instances where sufficient data did not exist.

Among the different kinds of mortality and growth loss data, fire data were the most complete. Numerous standard fire reports were available; these ordinarily show timber losses. For severe fires, special surveys are often made to evaluate damage. Delays in restocking and other indirect losses caused by fire were judged but with many previous situations to use as references and guides. The fire statistics on area protected, classes of protection, area burned, and control expenditures are of a high order of reliability; such statistics have been developed over the years as an essential phase of the integrated State and Federal fire control program.

The estimates of damage from insects and diseases were largely prepared by the entomologists and pathologists located at the Federal forest experiment stations. The estimates were derived in part from current surveys, as in the cases of many of the bark beetles, defoliators, white pine blister rust, and pole blight; in part from estimates based on a large amount of data on cull percents as in the case of heart rot; and in part from scattered studies and the considered opinion of those specialists who were best informed. Some of the estimates in this last category are those pertaining to tip moths, sawflies, leaf and needle diseases, and sweetgum blight. Cull percents used in calculating heart rot losses were based on a substantial body of data, and suitable allowances and weight-

ings were made according to site quality or other factors that influence them.

Two examples will indicate the kind of insect and disease data available: Mortality caused by the littleleaf disease in the Southeast came from 31 permanent plots in 5 States supplemented by records from 3,552 Forest Survey plots. Reduction in growth rate caused by the littleleaf disease was based on 5-year remeasurements of 565 individually tagged trees in all stages of decline on 35 permanent sample plots. Losses from western pine beetle attacks on ponderosa pine in California were obtained from complete inventories on more than 70 sample plots having an aggregate area of over 10,000 acres. Many other examples also might be cited where there was a large volume of data available for growth impact determinations by cause of damage.

In general, the estimates of mortality by cause, having been accumulated in most parts of the country by the Forest Survey on a large number of field sample plots, are more reliable than the estimates of growth loss by cause. The growth loss statistics represent no more than a first approximation. Neither the methodology nor the field force required for the accumulation of precise data on all types and causes of growth loss were available. Nevertheless, through a State by State appraisal by specialists of each element of growth loss, by causal agency, and by the major tree species involved, there is no doubt that the growth impact data in this report do represent an adequate basis for appraising timber losses over the Nation as a whole.

PRODUCTIVITY

The estimates of productivity of recently cut lands are relative rather than absolute. They can be understood and evaluated only in relation to the concepts on which they are based, as explained in the section Productivity of Recently Cut Lands. The productivity *criteria*, as such, are not subject to sampling or other errors. They are the result of the best professional judgment, research, and experience that could be brought to bear. On the other hand, the productivity *data* are subject to the possibility of both sampling and nonsampling errors. These errors are likely to be minor and the data are believed to be entirely adequate for describing the condition of recently cut lands by regions and ownership classes.[8]

A Special Study of Productivity Was Made

The condition of recently cut lands was determined by field examination. Data on small private ownerships were obtained by examining sample properties. For medium private ownerships, sampling procedures were also used in most States having 15 or more such ownerships; in all other States, every medium private ownership was covered by the study. Except for six properties to which access was denied, all large private ownerships were examined in every State but Florida, where they were sampled. Federal, State, and other public ownerships generally were covered 100 percent.

On both public and large private ownerships organized by working circles, each working circle was treated as an individual ownership and reported on separately. Where working circle organization was not used, each block or unit of land in the ownership recognized for administrative purposes was examined separately.

Field examinations were made by foresters familiar with the silvicultural requirements and growth characteristics of the local forest types. Group training for field men was provided to insure uniform interpretation of criteria used in the ratings.

The productivity ratings were made with consideration of the stand both before and after cutting, using the detailed criteria described in Criteria for Rating Productivity, page 671. Although the field examinations were made after cutting, the age, composition, stocking, and general thrift of the cut stand were estimated by observing and measuring stumps, tops, and other evidence left on the ground. The rating criteria used were chosen primarily to express directly either existing or prospective stand conditions, rather than intentions or actions of owners or economic or other indirect factors which influence stand conditions in varying degrees.

Four key factors affecting growth were recognized: (1) The density of crop trees in the residual growing stock left on the ground after cutting, together with such trees established since cutting, (2) prospective stocking as indicated by numbers and species composition of seed trees or other sources of regeneration and the relative abundance of inhibiting or beneficial factors affecting regeneration, (3) the species composition of existing stands, and (4) the effect of the actual felling age on the rate of growth.

When the ratings for a property having cuttings in several types were summarized, the rating for the recently cut area in a given type was weighted by the acreage of that type in the ownership. The same principle was followed in summarizing the ratings for all properties in a given class of ownership or in a region.

Sampling Procedure Affects Reliability

In the nationwide field survey made to appraise productivity on recently cut lands, the require-

[8] The adequacy of the ownership data, as distinct from productivity data, is described under Forest Land and Timber Ownership, p. 664.

ments of probability sampling were met and sampling errors were calculated for the major items of data. Sampling error goals were set for each region and were met satisfactorily. For the United States and Coastal Alaska as a whole, the sampling error of the estimate of total private operating area is 2.0 percent (table 84). Errors of the estimates of private operating area by productivity class range from 2.7 to 5.9 percent. Sampling errors of the public ownership data have not been calculated because coverage was generally 100 percent.

Figure 3 provides a means of approximating the sampling errors of further breakdowns of the items given in table 84. The application of figure 3 corresponds to that previously used for figure 1. For a particular breakdown, find the smallest unit of which it is a part and for which the sampling error is given in table 84, determine the percent of area which the breakdown represents, and read the corresponding factor from figure 3. The product of this factor and the sampling error of the whole is the approximate sampling error of the breakdown.

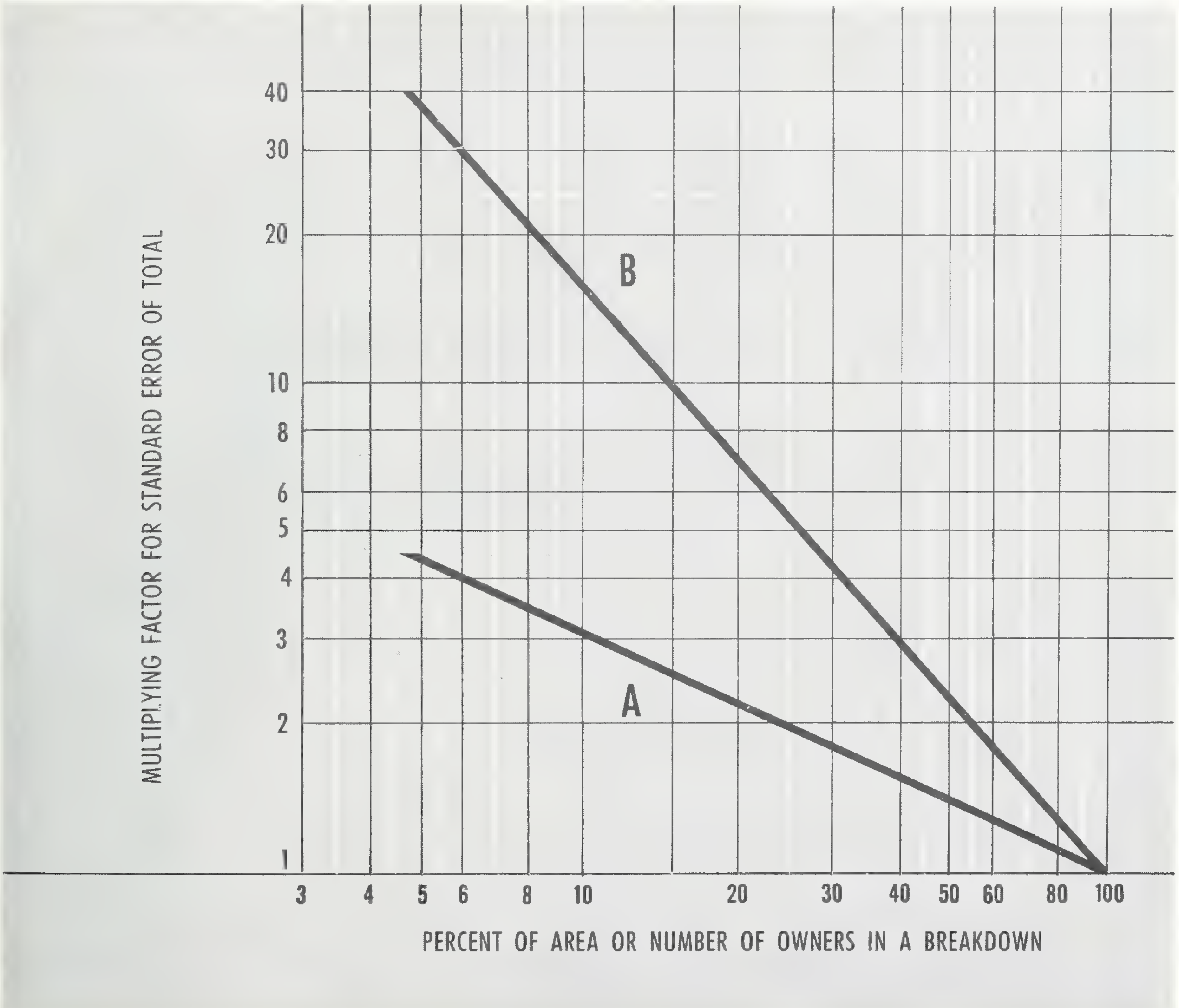

Figure 3.—Ratio of standard error of an area or number-of-owner breakdown to standard error of a total based on the survey of productivity of recently cut lands. (A) Applies to area and number-of-owner statistics for ownerships of less than 5,000 acres in California and the East. (B) Applies to area statistics of ownerships less than 5,000 acres in Pacific Northwest, Northern Rocky Mountain, and Southern Rocky Mountain Regions. Applies also to area statistics for ownerships of 5,000 to 50,000 acres.

TABLE 84.—*Sampling errors* [1] *of estimates of private commercial forest land, number of private ownerships, operating area, and area by productivity class, by size class of ownership, section, and region, United States and Coastal Alaska*

SMALL OWNERSHIPS (LESS THAN 5,000 ACRES)

Section and region	Commercial forest land area	Number of private ownerships [2]	Operating area	Productivity class [3] Upper	Medium	Lower
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
North:						
New England	3. 5	4. 9	8. 0	12. 6	13. 5	20. 0
Middle Atlantic	6. 1	4. 1	13. 6	16. 2	16. 0	49. [illegible]
Lake States	5. 3	3. 3	10. 6	13. 6	17. 5	19. 3
Central States	4. 3	6. 8	11. 1	14. 0	15. 6	27. 8
Plains	15. 9	15. 0	37. 7	(4)	(4)	37. 8
All regions	2. 6	2. 8	6. 0	7. 8	8. 2	17. 4
South:						
South Atlantic	5. 6	6. 4	9. 0	15. 0	14. 0	21. 2
Southeast	3. 5	4. 3	5. 3	12. 9	12. 6	11. 6
West Gulf	7. 8	5. 6	11. 8	20. 7	12. 0	15. 6
All regions	3. 0	3. 1	4. 6	8. 9	7. 7	8. 6
West:						
Pacific Northwest	3. 3	1. 9	5. 4	8. 4	9. 1	16. 8
California	10. 4	10. 7	16. 7	25. 8	21. 4	30. 1
Northern Rocky Mountain	8. 8	11. 0	10. 8	10. 5	18. 0	20. 5
Southern Rocky Mountain	11. 9	13. 1	28. 5	47. 7	40. 2	18. 5
All regions	3. 3	2. 9	4. 8	7. 6	7. 8	11. 8
All sections, United States	1. 9	2. 0	3. 4	5. 5	5. 1	7. 4
Coastal Alaska	0	0	0	0	0	0
United States and Coastal Alaska	1. 9	2. 0	3. 4	5. 5	5. 1	7. 4

MEDIUM OWNERSHIPS (5,000 TO 50,000 ACRES)

Section and region	Commercial forest land area	Number of private ownerships [2]	Operating area	Productivity class [3] Upper	Medium	Lower
North:						
New England	2. 3	0	2. 7	6. 8	47. 1	62. 6
Middle Atlantic	2. 3	0	6. 0	15. 0	18. 2	47. 9
Lake States	1. 6	0	9. 1	12. 0	28. 8	10. 6
Central States	3. 2	0	6. 3	11. 1	16. 1	47. 0
Plains	0	0	0	0	0	0
All regions	1. 2	0	3. 0	6. 4	14. 2	31. 8
South:						
South Atlantic	3. 7	0	7. 1	8. 7	33. 8	0
Southeast	3. 4	0	5. 6	9. 5	23. 4	19. 4
West Gulf	1. 8	0	4. 8	10. 4	12. 2	28. 8
All regions	2. 1	0	3. 6	6. 1	13. 4	16. 0
West:						
Pacific Northwest	4. 9	0	6. 6	12. 2	27. 0	63. 2
California	5. 6	0	8. 2	12. 6	49. 9	0
Northern Rocky Mountain	0	0	0	0	0	0
Southern Rocky Mountain	17. 9	0	0	0	0	0
All regions	3. 5	0	4. 4	8. 1	19. 2	30. 3
All sections, United States	1. 4	0	2. 4	4. 2	9. 2	13. 0
Coastal Alaska	0	0	0	0	0	0
United States and Coastal Alaska	1. 4	0	2. 4	4. 2	9. 2	13. 0

See footnotes at end of table.

TABLE 84.—*Sampling errors* [1] *of estimates of private commercial forest land, number of private ownerships, operating area, and area by productivity class, by size class of ownership, section, and region, United States and Coastal Alaska*—Continued

MEDIUM AND LARGE OWNERSHIPS (5,000 ACRES AND LARGER)

Section and region	Commercial forest land area	Number of private ownerships [2]	Operating area	Productivity class [3]		
				Upper	Medium	Lower
North:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
New England	0.5	0	2.1	1.3	6.7	7.1
Middle Atlantic	1.4	0	6.4	7.6	10.4	33.3
Lake States	.5	0	2.7	2.5	11.1	8.9
Central States	2.4	0	6.9	8.4	11.4	22.3
Plains	0	0	0	0	0	0
All regions	.5	0	1.9	1.6	4.7	21.5
South:						
South Atlantic	1.7	0	4.0	3.8	21.1	(4)
Southeast	1.7	0	5.3	4.8	21.4	23.7
West Gulf	.6	0	2.6	2.5	5.5	12.9
All regions	.9	0	2.9	2.7	10.0	15.1
West:						
Pacific Northwest	1.5	0	3.2	2.8	17.0	42.0
California	2.8	0	6.4	6.4	24.4	0
Northern Rocky Mountain	0	0	0	0	0	0
Southern Rocky Mountain	7.3	0	0	0	0	0
All regions	1.2	0	2.1	2.2	5.9	16.3
All sections, United States	.6	0	1.9	1.9	5.0	11.7
Coastal Alaska	0	0	0	0	0	0
United States and Coastal Alaska	.6	0	1.9	1.9	5.0	11.7

ALL PRIVATE OWNERSHIPS

Section and region	Commercial forest land area	Number of private ownerships [2]	Operating area	Upper	Medium	Lower
North:						
New England	2.1	----------	2.9	2.4	6.6	18.1
Middle Atlantic	5.2	----------	8.4	10.3	10.5	37.1
Lake States	4.5	----------	6.0	7.2	13.2	17.3
Central States	4.1	----------	8.7	12.2	13.7	26.2
Plains	15.9	----------	43.1	(4)	(4)	38.0
All regions	2.1	----------	3.2	3.9	5.2	14.7
South:						
South Atlantic	4.7	----------	6.3	7.8	12.6	19.5
Southeast	2.5	----------	4.6	5.6	10.6	10.4
West Gulf	5.1	----------	4.4	5.3	7.7	12.5
All regions	2.2	----------	3.0	3.7	6.2	7.7
West:						
Pacific Northwest	1.8	----------	2.9	2.9	8.1	17.4
California	4.2	----------	6.2	6.7	16.9	30.0
Northern Rocky Mountain	5.3	----------	3.6	2.3	6.7	10.2
Southern Rocky Mountain	7.4	----------	9.8	13.5	18.7	4.7
All regions	1.8	----------	2.2	2.5	5.1	9.7
All sections, United States	1.4	----------	2.0	2.7	3.6	5.9
Coastal Alaska	0	----------	0	0	0	0
United States and Coastal Alaska	1.4	----------	2.0	2.7	3.6	5.9

[1] Sampling error in terms of one standard error.

[2] No sampling error for ownerships of 5,000 acres and more because complete ownership lists were available and therefore sampling error was nil.

[3] Large sampling errors frequently apply to a small area or percentage in the productivity class. Sampling error of 40 percent applicable to 5 percent of operating area indicated in low productivity, for example, indicates range of $\pm(5 \times .40) = \pm 2$. The odds are 2 to 1 that the true percentage in the class would therefore fall in the range 3 to 7 percent.

[4] Estimates too crude for use on a State basis.

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In figure 3, line A applies to statistics obtained by area sampling. This includes private ownerships of less than 5,000 acres in all regions except the Pacific Northwest, Northern Rocky Mountain, and Southern Rocky Mountain, where list sampling was employed. Line B applies to statistics obtained by list sampling. This includes all ownerships in the size range 5,000 to 50,000 acres and small ownerships in the Pacific Northwest, Northern Rocky Mountain, and Southern Rocky Mountain Regions. Line B will apply also in approximating the sampling errors of breakdowns of all ownerships of more than 5,000 acres.

Nonsampling Errors May Have Occurred

In addition to sampling errors, the productivity data are also subject to other errors. These include possible mistakes in measurement, tallying and reporting, or compilation—the same possible mistakes previously mentioned in connection with other groups of data. However, the principal factor affecting reliability of the data was the use of personal judgment in applying the criteria. Judgment had to be used in classifying crop trees and seed trees, determining prospective stocking, appraising the condition of the seedbed, and so on. Finally, the productivity data are dependent upon the ownership data and their reliability is partly dependent upon the reliability of the latter.

The productivity criteria are believed to be adequate for rating purposes. Separate criteria were established for each forest type in every region, and for site classes, physiographic units, or localities within types as deemed necessary. In establishing them, tables of normal stocking and other technical benchmarks were adjusted to conform to the conditions found on recently cut lands of ownerships judged to be managed under the better cutting practices. Although the reliability of the criteria is not under consideration, it should be pointed out that professional judgment was exercised in coordinating standards for types common to two or more regions, and in determining the need for separate criteria for site classes, physiographic units, or localities within a type.

FOREST LAND AND TIMBER OWNERSHIP

The commercial forest land ownership data are among the most reliable data in the Timber Resource Review. They are adequate for most breakdowns, and their reliability is frequently sufficient for State analysis. The timber ownership data, though reliable enough for use in most States, are not quite as adequate. They cannot be broken down as finely as the area data, and there is no way of separating forest industry timber volumes from volumes owned by nonfarm private owners.

Ownership Data Tied to Forest Survey

Total commercial forest area, total sawtimber volume, and total growing stock estimates were obtained as explained above under Forest Area, Timber Volume, and Growth Data. Ownership procedures were aimed simply at segregating these groups of data by ownership class in terms of acreage, timber volume, and number of holdings.

Most of the estimates of private ownership of commercial forest land were obtained as part of the Forest Survey or as part of special surveys of forest area, timber volume, and growth. Public forest land areas were usually secured from the officials administering them. Private farm forest areas were derived from Census estimates. Forest industry and other private forest area was the calculated residual. The subdivision of these latter data into ownerships of lumber manufacturers, pulp manufacturers, other wood manufacturers, and other private owners was accomplished as a part of the survey of productivity of recently cut lands, just described. This survey also provided the estimates of number and area of private ownerships by size class.

Estimates of timber volume were based on public records or on aerial photograph interpretation and ground plot measurements. Regular Forest Survey procedures were used in most cases.

Sampling Errors Apply to Part of Ownership Data

Except for the area of public ownerships and the numbers of medium and large private ownerships, ownership data were obtained by sampling procedures. For the estimate of private commercial forest land in the United States and Coastal Alaska, the sampling error is 1.4 percent (table 84). For the total number of small private ownerships, the error due to sampling is 2.0 percent, and for the commercial-forest area of these ownerships it is 1.9 percent. Further breakdowns of these items can be calculated by using figure 3 as explained in connection with the productivity data.

The sampling error of total sawtimber volume is 0.8 percent, and the sampling errors for volumes owned by each of the various types of ownership are somewhat larger. The latter errors can be read from table 84 and figure 1 in the same manner as errors of other breakdowns of the forest land, timber volume, and growth data.

Some Ownerships Difficult To Classify

The possibility of human mistakes and faulty judgment affect the reliability of the ownership data just as they affect other data. Training, close supervision, and critical review of results helped to keep such errors to a minimum. However, ownership data are especially subject to two kinds of nonsampling error which are difficult to correct. These are errors of reporting and errors of classification. Reporting errors may arise where public or private records and reports are used in lieu of direct measurement to Forest Survey standards. Classification errors are of particular importance in all private ownership surveys because some farmers operate sawmills, for example, and some forest industrial firms manufacture both lumber and pulp. The possibility of misclassification has been minimized as much as possible by using standard definitions and by training enumerators to recognize marginal cases. Nevertheless, the possibility of such error does exist and there is no ready way of measuring it.

FOREST TREE PLANTING

The most reliable planting data are those which describe past accomplishments. Since 1926, State foresters have reported—and the Forest Service has compiled—areas planted annually, State by State. There are also fragmentary but reliable statistics available for many years before 1926. In using all of these planting records, judgment enters in only when converting from area planted to area of acceptable plantations. Since an acceptable plantation is defined in terms of number of trees per acre at the end of the fifth year after planting, data for plantations older or younger than 5 years could not be used without allowing for differences in plantation age. The plantable area data are believed to be adequate, but their reliability covers a wide range. This is because their preparation varied from State to State depending upon the availability of local information, and because a considerable degree of personal judgment was usually necessary.

In general, the estimates of area of acceptable plantations and plantable area were prepared jointly by State foresters and local Forest Service planting specialists. No special surveys were undertaken, but full use was made of existing data on stocking of commercial forest land such as the Forest Survey provides, results of planting surveys in some States, public forest records, and similar sources of information.

Comparability of the planting data is strongly affected by the local interpretation given to the standard definitions and concepts as explained in the section Forest Tree Planting. For example, plantable area is nonstocked or poorly stocked forest land or nonforest land on which, judged by 1952 conditions, (a) the establishment of forest tree cover is desirable and practical, and (b) forest tree regeneration will not occur naturally within a reasonable period of time. In each region, attempts were made to insure uniform interpretation of this definition. For example, "reasonable time" was taken to mean 5 years in poorly stocked seedling and sapling areas in the eastern forest types and in coastal conifer types in the West, and 10 years in interior types in the West. The data apply to virtually all of the nonstocked forest land and also to certain areas of seedling or sapling stands that were slightly in excess of 10-percent stocked and where local experience and judgment indicated that planting was practicable. The nonforest land included in plantable area generally pertains to former timberland diverted to cropland, but which now lies idle and no longer is used for such purpose; nonforest land in use as cropland was not included.[9]

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TIMBER RESOURCES OF NORTH AMERICA AND THE WORLD

The data presented in the section on timber resources of North America and the world came from many sources, and many adjustments had to be made to place them all on a common base. No evaluation of these foreign statistics can be offered since none is given in the references consulted. The point to be made is that forest inventories have never been made in most of the countries of the world outside of North America and parts of Europe. The data are indicative and no great reliability should be attributed to most of them.

The estimates for Canada were taken mainly from reports of the Canadian Department of Northern Affairs and National Resources. An advance draft of the statement on Canada was reviewed in the Forestry Branch of that Department. The Canadian estimates are believed to be more reliable than the estimates for most other countries.

The estimates for Mexico are based on fragmentary data that were brought together from various sources. Major reliance was placed on "Informe al Gobierno de Mexico sobre Silvicultura," a report by D. T. Griffiths which was published in 1954 by the Food and Agriculture Organization of the United Nations.

The major source of the data given for the rest of the world was "World Forest Resources," also published by the Food and Agriculture Organization and released in 1955.

[9] Cropland which might be planted under various public programs subsequent to 1952—the "Soil Bank," for example—is not included.

FUTURE DEMAND AND SUPPLY

The projections of future demand for timber and the estimate of needed growth and inventory and of projected growth and inventory are different from all of the other data in the Timber Resource Review. Their adequacy can be gaged only in relation to the assumptions upon which they are based. They are believed to be sufficiently precise for the purposes for which they are used. However, these data or any other system of projections cannot have the same reliability as measurements of past economic growth or of quantity of timber products demanded currently or in the past. "We cannot ask about a statement concerning the future, 'Is it true?' as we can ask about one relating to some past event. All we can ask, 'is it likely to be true?' meaning 'Are there weighty grounds for accepting it?' The answer to this question, no matter how strongly supported by empirical study of the past, is merely a matter of judgment that cannot be fully tested." [10]

Future Demand Closely Related to Future Economic Expansion

The projections of future demand for timber are based chiefly on a general framework of projections indicating probable expansion of the Nation's economy in the forthcoming 20 and 45 years. The construction of those projections is explained step by step in the section Future Demand for Timber.

The starting point is the Census Bureau's four series of United States population projections covering the period 1955 to 1975. These are based on explicit assumptions regarding future fertility rates, mortality rates, and net immigration. The same assumptions and method have been used to extend the Bureau's series from 1975 to the year 2000. From those series of projections (and extensions), two sets of estimates for 1975 and for 2000 population have been chosen. The lower set of estimates for these two dates is somewhat below the midpoint between the two middle series of projections; the upper set is the high series. Reasons for not using the low series are indicated in the section.

From the selected estimates of future population, the analyses proceed to derive corresponding sets of estimates of the future labor force. Those labor force figures, with due allowance for (a) some decrease of participation by young persons of school age and by elderly persons of retirement age, (b) armed forces of about present size, (c) unemployment not exceeding 4 percent of the future labor force, (d) continuing reduction of average hours of work per year by employed persons, and (e) annual average increase of man-hour productivity at rates somewhat lower than in recent years, are the basis for projections of the Nation's future outputs of all goods and services, or gross national product. The gross national product projections, in turn, are the basis for estimates of future disposable personal income, and also for projections of the inputs of nonfood-nonfuel raw materials required to sustain such outputs.

Within this general framework of anticipated economic growth, three separate projections of demand for timber products have been developed. The first is based on the lower set of population and gross national product projections; the second is based on the upper set; the third projection of demand for timber products is a modification of the first, on the assumption that prices of timber will rise to a substantially greater extent than prices of competing materials. All three demand projections assume continuation of trends in substitution of certain timber products for other timber products. But only the third assumes substantial net substitution of other nonfood-nonfuel raw materials for timber products.

The final steps in the timber-demand analyses involve assumptions about future net imports of timber products, and about future improvements in timber utilization. With allowances for these two factors, the analyses proceed to estimates of future demand for live timber from the forests of the United States.

Wanting to know how its preliminary projections of national economic growth and of demand for timber products would fare under critical judgment, the Forest Service sought and obtained independent appraisals of those projections by several experienced economic analysts not connected with the Service. Comments from some other economic analysts were volunteered and have proved most helpful.

Future Supply Data Involve Additional Assumptions

The estimates of future needed growth and inventory rest mainly on the estimates of future timber cut, but they also involve additional assumptions. There is still much to be learned about projecting growth on a nationwide basis. Until more is learned, any long-range calculations will have inherent in them the possibility of substantial error. Growth is a compounding value and even small variations of growth rate can have pyramiding effects which are hard to evaluate. Furthermore, the task of relating timber cut projections, growth, and inventory to long-range wood needs is complex; available methods are crude; there is no way of making precise comparisons; and professional judgment, as well as

[10] Kuznets, Simon. *Concepts and Assumptions in Long-Range Projections of National Product.* *In* v. 16, Long-Range Economic Projection, pp. 9–38. Natl. Bur. Econ. Res. Princeton, N. J. 1954.

assumptions, play an important role in the procedure.

The needed growth estimates are no more than the projections of timber cut from Future Demand for Timber plus an allowance for possible underestimation, catastrophic losses, and reduction in commercial forest area. The needed inventory estimates are capitalized values calculated from the needed growth figures. The capitalization rates used represent the weighted average mean annual growth (including growth harvested in thinnings or intermediate cuttings) of well-stocked stands of each region's important timber types at appropriate rotation ages. The rotations selected were those deemed necessary on the average to provide timber of the size and quality implicit in the future demand estimates under the intensity of protection and management which might prevail in the year 2000.[11] When the results from all regions are brought together, the capitalization rates applied to needed sawtimber growth were found to average 5.4 percent for eastern softwoods, 4.4 percent for eastern hardwoods, 3.7 percent for all species in the Douglas-fir subregion, and 2.8 percent for all species in the remainder of the West. Corresponding rates in terms of growing stock averaged 4.6, 4.0, 3.3, and 2.0 percent, respectively. All of the capitalization rates and rotation ages chosen are considered practicable and feasible, but they may be subject to errors.

Projected growth and inventory estimates also are dependent upon the estimates of future demand plus an allowance. In addition, they involve the assumptions that (1) forestry progress will continue at the rate shown by recent trends, and (2) timber will be cut each year from 1952 to the projection dates as demand steadily rises from 1952 consumption to the projected levels. The former assumption is based partly on resurveys and other plot remeasurement data and partly on judgment. It takes into account intensified protection with consequent substantial reductions in mortality, rapid expansion in tree planting, increased growth rates in the West resulting from liquidation of old-growth timber and improvement in forestry, and decreased growth rates in the East as understocked stands fill in. If more adequate information had been available, it would have been desirable to calculate these and other items of forestry progress independently instead of selecting rates of growth and rates of mortality that purport to include them all, as was actually done. The procedures used varied from region to region depending upon differences in the nature of the forest itself and in the statistical data available. Some formulas provided for separate calculation of ingrowth, for example, while others used a gross growth rate which included ingrowth.[12] The details of procedure are fully described in the working plans which may be consulted in Forest Service regional offices, as mentioned previously.

Finally, the estimates of realizable growth should be mentioned. They were prepared by groups of local foresters in each region who were acquainted with the growth achieved on the best managed properties in their regions. Records of growth and yield were used where available, along with information on areas of types and sites. However, in the last analysis, the results are based mainly on professional judgment. They should be used only as indicators of the levels of growth that might be considered reasonably attainable.

[11] Calculations of needed inventory were made independently in each region. Examples of rotations used include: 60 years for southern yellow pine, 80 years for eastern hardwoods, 100 years for Douglas-fir, and 120–150 years for ponderosa pine. In such calculations, the longer the rotation needed to produce a desired range of size classes, the greater the ratio of timber volume to annual yield and the smaller the capitalization rate to convert needed growth to needed inventory.

[12] The following formulas, or variations of them, were used in most cases for projecting inventory and growth for specified years:

$$A=[(GS-\tfrac{1}{2}C-M)\ .0s-\ (C+M)]\ \frac{1.0x^n-1}{.0x}$$

where A = Addition to the growing stock during the period
GS = Growing stock at the beginning of the period
C = Average annual cut during the period
M = Mortality in first year of the period
$.0s$ = Average annual gross growth rate during the period
$.0x$ = Gross growth rate minus the mortality rate.

$$NG=(GS-\tfrac{1}{2}C-M)\ .0s-M$$

where NG = Net growth during an individual year
GS = Growing stock at the beginning of the year
C = Timber cut during the year
M = Mortality during the year
$.0s$ = Annual gross growth rate.

Appendix

Criteria for Rating Productivity

CONTENTS

CRITERIA FOR RATING PRODUCTIVITY[13]

INTRODUCTION

In making the field ratings for productivity of recently cut lands, the existing stocking, prospects for future stocking, species composition, and felling age practiced thereon were measured and recorded in terms of specific criteria or guides. Because regional foresters of the Forest Service were assigned responsibility for conducting the surveys, detailed criteria and field manuals were prepared for each of the administrative regions of the Forest Service according to the methods outlined in the section Productivity of Recently Cut Lands, p. 225. The reader will also find in that section the reasons for procedural steps and the concepts basic to the standards presented here.

The purpose of the following pages is to preserve and to make public the major standards used in the 1953 survey. To avoid repetition of definitions and procedures common to several regions or types, and to reduce space devoted to tabular presentations, the criteria used for rating productivity are summarized and condensed for type groups within the several Timber Resource Review regions or combinations of them. Voluminous material on the mechanics of procedure, such as the coding system used to record field data and the sampling procedures followed, has been omitted. Also, some of the minor guides, important locally, have been omitted.

The subject matter under consideration is technical and highly complex. Technical readers interested in the procedures and standards for a given forest type in a particular locality should obtain a copy of the field manual from the appropriate regional forester and also a copy from the Chief Forester of the basic plan entitled "Task VIII, Productivity of Recently Cut Lands—July 1953."

DEFINITION AND EXPLANATION OF TERMS

The definitions and explanations that were applied in all regions and in all forest type groups are summarized below. Important exceptions and additions to meet local conditions are given in the criteria for the regions and type groups in which they occur.

Crop Tree

Only crop trees were counted in the field sampling to estimate stocking. "Crop trees" were defined as trees of desirable or acceptable species as specified in the individual type-group descriptions and which by local experience have proved their ability to produce commercial wood products on the site under examination and, if below commercial size, show capability of growth to merchantability by reason of their form, vigor, crown position, and freedom from injury, disease, and parasites. Only mature specimens or those capable of making good growth at the time of examination qualified as crop trees. Ability of a young tree to survive a period of suppression and eventually develop into a crop tree did not qualify it to be counted.

Effect of Felling Age

Effect of felling age is the reduction of productivity that results from clear cutting or very heavy cutting in stands before the culmination of mean annual growth for the class of products removed. It is expressed as that percentage of the mean annual growth at culmination reached by the stand at the age when clear cut. Thus, if a given species culminates mean annual growth at 120 years with a mean annual growth of 200 volume units, but was cut at 80 years when mean annual growth was 150 units, allowance for this effect of felling age reduced the productivity rating by 25 percent.

Effects of felling age were recognized for two general classes of products depending upon plurality of the volume cut: (a) Large products and high-quality products such as saw and veneer logs, and (b) small, relatively lower quality products such as cordwood. Products that did not fit this classification, such as Christmas trees, corral poles, fencing material, and transmission poles, were assumed to have reached maturity at the age cut, and felling-age effect was not considered. Also, no reduction for felling age was made either for stands or individual trees whose removal did not have a material effect in reducing growth. Examples: (a) Injured and diseased trees or stands, (b) trees in the suppressed crown classes,

[13] Assembled by Leonard I. Barrett, Philip A. Briegleb, Gordon G. Mark, and Arthur L. Roe.

and (c) trees or overstory stands impeding understories having potentially higher value.

Seed Trees

Seed trees were required to have a full, healthy crown and reasonable prospects of surviving for a sufficient time to bear at least one full crop of seed.

Forest Types

The forest type groups adopted by the nationwide forest survey (see Definitions, p. 630) were used as the basic types in compiling results. However, criteria were prepared by the regional task groups for local types as considered important. These local types were keyed to the most appropriate type group for compilation purposes. For this reason, criteria will appear in the following pages for types not listed in the major type groups. For example, in the Middle Atlantic Region only the white pine type of the type group white-red-jack pine exists on the ground. Hence, stocking standards were prepared only for the local white pine type. Basis for type classification was the species composition just prior to the most recent cutting.

Species Classification

For each forest type recognized in the regional criteria, the principal tree species encountered are listed as "desirable," "acceptable," or "noncount," depending on their rate of growth, susceptibility to injury and parasites, and the utility of their products in comparison with that of associated species. Classification of minor species of relatively little importance not listed in the criteria was determined by the field examiners as encountered.

Established Seedlings

Healthy seedlings of desirable or acceptable species that have completed one growing season, and that meet crop tree specifications, are designated as "established," unless specified otherwise in the individual criteria.

Clear Cuttings

Clear cuttings are defined as cuttings that remove all of the trees or all or substantially all of the trees that are merchantable for the products being harvested, and that result in elimination of most of the original overstory. In the East, when 80 percent or more of such merchantable volume was removed, the area was considered clear cut.

PROCEDURES FOR EASTERN UNITED STATES

In the eastern part of the country, including North Dakota, Oklahoma, and Texas, the productivity classification of recently cut lands was derived from numerical ratings based on tallies of sample plots distributed throughout the cutover areas.

The existing stocking was tallied on concentric circular plots, a $\frac{1}{100}$-acre plot being used for trees up to the 6-inch d. b. h. class, and $\frac{1}{5}$-acre plots used for trees in the 6-inch d. b. h. class and larger. The "desirable" and "acceptable" species were recorded by these two categories, and ratings of existing stocking were read from stocking tables prepared from the standards for the type.

If this step shows that 50 percent or more of the stocking was in desirable species, no correction was made for composition. If less than 50 percent was in desirable species, the rating was reduced by applying a composition factor. In order not to reduce existing stocking by more than half because of substandard composition, no factor under 0.5 was used.

If the plot was not fully stocked, prospective stocking was calculated by various methods based on the standards for the particular forest type. Generally, the prospective stocking rating was based on: (1) the available seed source—either from seed trees on the cutover area and/or from an adjacent uncut stand that contained seed-bearing trees, and (2) the condition of the seedbed, existence of slash, cull trees, weed trees, or herbaceous growth on the plot that would inhibit establishment or growth of trees. The effects of grazing, rodents, deer browsing, etc., were included in the final numerical estimate for prospective stocking.

Figures for existing and prospective stocking were added to obtain a value for total stocking. The maximum value recorded for stocking was 100 percent. If the stand was cut heavily, i. e., more than 80 percent of the volume in merchantable sizes for the products harvested was removed, and the trees were cut at ages younger than the age of culmination of mean annual growth for the class of product harvested, the rating was reduced by applying a felling-age factor. In even-aged stands, average age was used as the felling age to ascertain the factor. In uneven-aged stands, a weighted average factor was calculated. The final productivity estimate was the product of stocking percentage, the composition factor, and the felling-age factor.

Sample Calculation of Productivity

A productivity estimate was calculated on a field worksheet for each plot. The estimate for a given forest type on an ownership was the average of all plots in the cutover part of the type. To

illustrate the field procedure, a sample calculation for one plot, and the record made on a field worksheet for that plot (fig. 4), are given here. The State—Virginia (criteria for the South Atlantic TRR Region used); the forest type—loblolly-shortleaf pine cut 1 year before the examination.

Owner (name) John Doe (Number) ______ Forest type L.-SL Pine
Plot number 1

EXISTING STOCKING

Size class	Desirable		Acceptable	
	No.	Stocking %	No.	Stocking %
Repro.				
2			··	25
4	·	17		
6	···	4		
8			··	4
10				
12			·	4
14				
16				
18				
20				
22				
24				
Total		21		33

Total existing stocking 54 % (A)
Prospective stocking 19 %
Total stocking 73 % (B)

PROSPECTIVE STOCKING OF DESIRABLE SPECIES

Seed trees per acre			Other seed sources		Total prosp. stock. %	% of plot Area pot. stockable	Final prosp. stock. %
D.b.h.	No.	Stocking %	Dist. chs.	Stocking %	(1)	(2)	(1)x(2)
6							
8							
10	·	6					
12	·	8					
14	··	20					
16 +							
Total		34	6	30	64	30	19

EFFECT OF FELLING AGE OR SIZE

Even-aged stands	Uneven-aged stands						
	Stump						
age count on stumps	Sp.	D.i.b.	Age	No.	Stocking factor (1)	Felling factor (2)	(1)x(2) (3)
	L.P.	12	40	·	4	1.00	4.00
	S.P.	10	35	·	3	.98	2.94
	S.P.	10	30	·	3	.94	2.82
	S.P.	8	30	··	4	.94	3.76
	S.P.	6	25	···	4	.82	3.28
	S.P.	6	30	·	1	.94	.94
	L.P.	8	25	··	4	.90	3.60
	S.P.	12	50	·	4	1.00	4.00
	NONGROWING STOCK (DEFECTIVE, ETC.)						
		6		··	2	1.00	2.00
Total					29		27.34
Average							
Factor							

Weighted factor $= \frac{(3)}{(1)} = \frac{27.34}{29} = .94$

.29) .2734 = 94
261
124
116
8

.27) .2100 = 78
189
210
216

.78
.54
312
390
.4212

.94
.61
94
564
.5734

Adjustment for composition:

$$\text{Composition factor} = \frac{\text{Stocking \% of desirable species}}{\text{Total existing stocking \% x 0.5}} = \frac{21}{54 \times 0.5} = \frac{21}{27} = .78$$

Stocking modification for composition = Factor x total existing stocking
= .78 x 54 = 42

Add prospective stocking 19
Total adjusted stocking 61 (C)

Final rating = Adjusted stocking x felling factor: 61 x .94 = 57 (D)

Entries at (A), (B), (C), and (D) will be recorded on field form.

Figure 4.—Field worksheet.

439296 O—58——45

Existing Stocking

Crop trees recorded on the ¹⁄₁₀₀-acre plot:
- Desirable species—1 tree 4 inches d. b. h.
- Acceptable species—2 trees 2 inches d. b. h.

Crop trees recorded on the concentric ⅕-acre plot:
- Desirable species—3 trees 6 inches d. b. h.
- Acceptable species—2 trees 8 inches d. b. h.
  1 tree 12 inches d. b. h.

These trees were tallied in the columns headed "No." (see upper left block of fig. 4). The stocking percentages shown there were taken from a stocking table (table 85) prepared for field use from the basic standards given in table 101. (Similar tables were prepared for all types and in some cases by sites (Central States hardwoods) based on the standards of number of trees of various sizes needed to rate 100-percent stocking.) The stocking percentages were then totaled. Results: 21 percent for "desirable" species and 33 percent for "acceptable" species. The total existing stocking estimate was thus 54 percent. In other words, 54 percent of the area was estimated to be occupied by crop trees of "desirable" and "acceptable" species.

Existing Stocking Modified by Composition

Since less than 50 percent of existing stocking was composed of "desirable" species, an adjustment was made by use of a composition factor, calculated by the following formula:

$$\text{Composition factor} = \frac{\text{existing desirable stocking \%}}{.5 \times \text{existing total stocking \%}}$$

Example:

$$\text{C. F.} = \frac{21}{.5 \times 54}$$

$$\text{C. F.} = \frac{21}{27} = .78$$

Therefore, the estimate for existing stocking was reduced by applying the factor 0.78. The adjusted estimate for existing stocking was then $78\% \times 54\% = 42\%$.

TABLE 85.—*Crop tree stocking standards for the South Atlantic, Southeast, and West Gulf Regions, by diameter class*

¹⁄₁₀₀-ACRE PLOT (RADIUS PLOT 11.8 FT.)

Diameter breast high (inches)	Stocking percent when number of trees on plot is—											Number of trees per acre for 100-percent stocking
	1	2	3	4	5	6	7	8	9	10	20	
Reproduction	10	20	30	40	50	60	70	80	90	100		1,000
2	12	25	38	50	62	75	88	100				800
4	17	34	51	68	85	100						590
⅕-ACRE PLOT (RADIUS 52.7 FT.)												
6	1	2	4	5	6	7	9	10	11	12	25	400
8	2	4	6	8	10	12	15	17	19	21	42	240
10	3	6	10	13	16	19	23	26	29	32	65	155
12	4	9	13	17	22	26	30	35	39	44	87	115
14	6	11	17	22	28	33	39	44	50	56		90
16	7	14	21	28	35	42	49	56	62	69		72
18	8	17	25	33	42	50	58	67	75	83		60
20	10	20	29	39	49	59	69	78	88	98		51
22	12	24	36	48	60	71	83	95	100			42
24	14	28	42	56	69	83	97	100				36
26	16	32	48	65	81	97	100					31
28	19	37	56	74	93	100						27
30	21	42	62	83	100							24
32	24	48	71	95								21
34	26	53	79	100								19
36	29	59	88									17
38	33	67	100									15

TABLE 86.—*Prospective stocking of loblolly-shortleaf pine in the South Atlantic, Southeast, and Gulf Regions, by seed-tree size class*

Diameter breast high (inches)	Prospective stocking percent when number of seed trees per acre is—															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
10	6	13	20	25	30	37	45	51	59	65	71	77	84	90	97	100
12	8	16	24	32	40	48	56	64	72	80	88	96	100			
14	10	20	30	40	50	60	70	80	90	100						
16	13	27	40	53	67	80	93	100								
18+	22	44	67	89	100											

Prospective Stocking

Since the area was not fully stocked, the prospects of future stocking were considered. The following pine seed trees were observed on a concentric 1-acre plot: one 10 inches d. b. h.; one 12 inches d. b. h.; two 14 inches d. b. h. These were tallied under "Seed trees per acre" on the field worksheet, and the corresponding prospective stocking percentages shown in table 86 were recorded. This table was derived from the basic standards presented on page 689.

The sum of the ratings for the various seed trees was 34 percent. In other words, the seed trees remaining were estimated to be capable of producing seed enough to restock the plot to 34 percent of full stocking. Other seed sources were considered, such as seed from adjoining uncut stands of seed-bearing trees. The center of this plot was 6 chains from a seed wall of uncut pines. This was recorded under "Other seed sources (distance in chains)." The corresponding prospective stocking (30 percent) was taken from the appropriate seed source standard (page 690) which indicated that 30-percent stocking will result, on the average, from seed dispersed from a source 5½ to 6½ chains distant.

Therefore, sufficient seed was expected to fall on this ⅕-acre plot to restock the unstocked portion of the area 64 percent of full stocking: Seeds from seed trees, 34 percent+seeds from seed wall, 30 percent=64 percent. This sum was recorded under the column heading "Total prospective stocking (percent)."

The field examiner then estimated the percentage of the ⅕-acre plot that was capable of being restocked by the seed source. In this example, 54 percent of the area was occupied by existing stocking, which left 46 percent unstocked. If there were cull trees, brush, or other adverse conditions on a portion of the unstocked area, the portion so occupied was deducted to arrive at the proportion of the plot area estimated to be capable of restocking. Grazing damage and other factors were considered in arriving at the entry made here. In this case, for example, it was determined that cull trees, brush, etc., occupied 16 percent of the plot area that was not stocked, leaving only 30 percent of the area available for future stocking.

The final prospective stocking estimate then was computed as the product of the "Total prospective stocking (percent)" and the "Proportion of plot area restockable," or $64 \times .30 = 19$ percent. This added to the total existing stocking $(54+19)=73$ percent. The final prospective stocking percentage added to the percentage of adjusted existing stocking gives a total adjusted rating of 61 percent, i. e., $19+42=61$. The final productivity rating for the area would be 61 percent if the timber was not cut prematurely, or if the cutting was only a partial cut. However, the example assumes a heavily cut, uneven-aged stand, which requires calculation of a weighted rating.

Effect of Felling Age

In this example, the following stumps were recorded, by species, on the field worksheet:

Species:	*Diameter inside bark (inches)*	*Age (years)*
1 loblolly pine	12	40
1 shortleaf pine	10	35
Do	10	30
2 shortleaf pine	8	30
3 shortleaf pine	6	25
1 shortleaf pine	6	30
2 loblolly pine	8	25
1 shortleaf pine	12	50
2 nongrowing pines [1]	6	

[1] These two stock trees appeared to have been severely suppressed or defective.

The stocking factors were then recorded from the existing-stocking table (table 85). D. i. b. on stump was considered to be d. b. h. for this purpose.

The felling factors were read from the standards showing the proportion of peak mean annual growth reached at various ages by different species cut for cordwood (table 102, columns 3 and 5). These were recorded in the column headed

"Felling factor." The products of the stocking percentages and the corresponding felling-age factors were computed, and these products totaled. (The felling-age factor for the nongrowing stock trees is always 1.00.) The total of these products was 27.34. The total stocking percentage for the stumps tallied was 29. Therefore, the weighted felling-age factor is $\frac{27.34}{29}=.94$.

Final Productivity Rating

The estimated total adjusted stocking percentage is multiplied by the felling-age factor to obtain the estimated productivity rating for the plot. The final rating for the plot is the product ($61\times .94=57$ percent).

The sample calculation of productivity given here was chosen to include all possible factors. Quite often in the 1953 survey, calculation of a composition factor was unnecessary because 50 percent or more of the existing stocking was composed of "desirable" species. Also, no felling-age factor was calculated when stands were partially cut, i. e., when less than 80 percent of the volume of merchantable sizes was removed. Often the calculations required to obtain a weighted felling factor for uneven-aged stands were not needed because of the even-aged character of the stand cut.

PROCEDURES FOR WESTERN UNITED STATES

In the West, including South Dakota, Nebraska, and Kansas, stocking, composition, and the effect of felling age were measured by the point sampling method. Applied to stocking, this method is based on the concept that when a number of sample points are classified according to presence or absence of stocking at each point, the percent of total points classed as stocked is an estimate of the percentage of the area stocked. In using the system, methods were prescribed to provide for location of sample points without bias and distribution of them over the entire area being sampled.

Existing Stocking

The examiner first determined for each observation point whether or not the growing space represented by that point was stocked with a crop tree. Decision was based on stocking tables showing the maximum radii within which trees of various sizes must occur to classify the point as stocked. Where two or more trees occurred within prescribed radii, the closest tree to the point having an equal or better chance of survival than its competitors was used to determine the stocking. As shown in the regional stocking tables, for example table 104. the area stocked is directly related to tree size, i. e., the larger the tree the greater the area stocked by it.

The species of crop tree stocking the point was recorded on the field worksheet as either "D" or "A" (for desirable or acceptable, respectively) in accordance with species listings for each type or type group. Certain species were considered as noncount in the type criteria. Where only noncount species occurred within prescribed radii, the point was classed as nonstocked.

Prospective Stocking

When a sample point was not stocked with an existing crop tree, the examiner determined whether or not the chances for future stocking were favorable. The decision was based on guides for each forest type or type group. Such guides recognized distance to acceptable seed source, competing undesirable vegetation, and other measurable factors affecting reproduction. The point was classified as prospectively stocked if it met the standards given in the guides; otherwise it was classed as nonstocked.

After all of the points in a timber type within a cutting area had been classed as stocked or nonstocked, the total number stocked (including both existing and prospective) was expressed as a percent of the total number of points examined.

Points falling on old roads and skidways that were to be used again before a new tree crop reached usable size were reported as nonstocked.

Effect of Composition [14]

In order to measure the effect of species composition, species that stocked or showed potentials for stocking the points were classified as desirable or acceptable according to individual type criteria. For each type, a standard of at least 50 percent of the points stocked with desirable species was established. The ratio of points stocked with desirable species to all stocked points was calculated. This ratio was then compared with the 50-percent standard. If the ratio obtained was equal to or greater than the standard, no adjustment was made. Otherwise the ratio was divided by the standard and the quotient obtained was used as the adjustment factor. If the adjustment factor obtained was less than 50 percent, the factor 50 was used.

[14] The calculations referred to here were completed in the field by each examiner, except for a part of the data collected in California, Oregon, and Washington. Calculations from basic data collected in those States were completed in the Washington Office of the Forest Service. The results of additional supplementary data taken in the three States are presented in the section Productivity of Recently Cut Lands, p. 263.

Effect of Felling Age[14]

The following procedure was used on cutover areas or portions thereof that had been clear cut; it was not used on partially cut areas. At each point, the species of tree stocking the point prior to cutting was identified and its age or age class was determined by inspection of annual rings on the stump. The felling-age factor was then read from tables in the appropriate type criteria, and this factor was recorded as a part of the record for the point.

Sample Calculation

Table 87 is an example of the type of field data taken and the calculations applied.

GENERAL STANDARDS OF CLASSIFICATION APPLICABLE TO ALL REGIONS

1. Species not listed in the standards as "desirable" or "acceptable" were considered "noncount" in rating existing stocking. An exception was made for the occasional situation where an unlisted species was locally useful for a special product. Field examiners were instructed to exercise their judgment in classifying such a species as "desirable" or "acceptable" in the locality.
2. Species composition of the stand affected the rating for existing stocking only where less than 50 percent of the stand was composed of desirable species.
3. No composition factor less than 50 percent was used. Lower factors were raised to 50 percent.
4. In rating prospective stocking, consideration was given to available seed supply and to such conditions as the presence of cull trees, weed species, sod, or other herbaceous plant growth that would preclude the establishment or growth of trees. The effects of grazing, rodents, deer browsing, etc., were also considered if there was evidence that new seedlings were being killed, or deformed to the extent that they would not develop into crop trees.
5. Any points or plots or portions thereof dominated by a tree or trees not qualifying under the definition of crop tree were considered nonstocked regardless of other trees present or prospects for regeneration, unless acceptable plans by the owner to remove such trees were in evidence.

Consideration was given by the examiner to the success of past similar work, the relation of the area treated annually to the area cut over annually, outstanding orders or contracts to accomplish the work, and similar tangible evidence bearing on productivity. If he was not satisfied with the evidence, or if he considered the planned action to be problematical, the area was rated on the basis of conditions at the time of examination.

6. In the event that planned slash disposal, reforestation or timber stand improvement was incomplete on an area chosen to be sampled, the next most recent cutting in the ownership on which such treatment had been completed was examined. If this substitution was not possible, due allowance was made for the effects of such anticipated treatment if the examiner was satisfied that such plans would be carried out promptly.

Table 87.—*Calculation of productivity rating by the point method of field examination*

Point	Stocking, by species desirability[1]		Felling-age factor
	Existing	Prospective	
1	A		1.0
2		A	1.0
3			.5
4			.5
5	D		.5
6	A		1.0
7	A		1.0
8			1.0
9		D	1.0
10			.7
11			.7
12	D		.7
13	A		.7
14	A		1.0
15		D	1.0
16		A	1.0
17	D		1.0
18	D		1.0
19			1.0
20		A	1.0
			17.3

[1] A=acceptable species. D=desirable species.

Example:

Points stocked D=4+2= 6
A=5+3= 8
—
14

Existing stocking: 9÷20=45 percent
Existing+prospective stocking: 14÷20=70 percent
Existing+prospective stocking modified by composition:

Factor $\frac{6}{14\times.5}=.86$ $.86\times70=60$ percent
Felling-age factor=17.3÷20=86 percent
Combined rating=60×.86=52 percent

TABLE 88.—*Classification of species according to forest type group, New England and Middle Atlantic Regions*

Species	Spruce-fir	White-red-jack pine	Maple-beech-birch	Oak-hickory	Loblolly-shortleaf pine	Oak-pine
Ash spp	[1] D	D	D	[2] D		D
Aspen, bigtooth	[3] A	[4] A	[5] A			
Aspen, quaking	[6] A	[7] A	[8] A			
Baldcypress				A		D
Basswood		[9] D	D	D		
Beech	A	A	A	A		
Birch, paper	[10] D	[11] D	D			
Birch, sweet	A	A	[12] A	A		
Birch, yellow	D	A	D			
Blackgum				A		A
Butternut				A		
Cherry, black	A	[13] A	D	[14] D		
Cucumbertree			D	D		
Elm			A	A		
Fir, balsam	D	[15] A	A			
Hemlock	D	D	D	D		
Hickory spp		A	[16] A	A		A
Locust, black			[16] D	A		
Maple, red	[17] A	A	[18] A	A	A	A
Maple, sugar	D	D	D	D		
Oak, black		D		[19] D		D
Oak, chestnut		A		[19] D	A	A
Oak, pin				A		A
Oak, post				A		
Oak, red (north. & south.)		D	D	D	D	D
Oak, scarlet		A		A		A
Oak, shingle						A
Oak, white (north. & south.)		[19] D	[20] A	D	[19] D	D
Pine, loblolly					D	D
Pine, pitch		A		A	D	D
Pine, pond					D	
Pine, shortleaf				D	D	D
Pine, red	D	[21] D	D		D	
Pine, Virginia				A	D	D
Pine, white	D	D	D	D	D	D
Redcedar		[22] D		A		D
Spruce	D	D	D			
Sweetgum				D	A	D
Sycamore				A		
Tamarack	[19] D					
Walnut, black				D		
White-cedar	[5] D			A		
Yellow-poplar		D	D	D	D	D

A=Acceptable species. D=Desirable species.

[1] Brown ash is listed as acceptable in New Hampshire.

[2] Acceptable in Pennsylvania.

[3] Noncount in all States except Maine and New Hampshire.

[4] Noncount in all States except Maine and western Massachusetts.

[5] Noncount in all States except Maine, New Hampshire, Massachusetts, Pennsylvania, and northeastern New York (State District Nos. 9 and 10).

[6] Noncount in all States except New Hampshire.

[7] Noncount in all States except in the extreme northeastern part of New York (State District No. 9) and in western Massachusetts.

[8] Noncount in all States except Massachusetts, Pennsylvania, New Hampshire, and northeastern New York (State District Nos. 9 and 10).

[9] Acceptable in Maine, Massachusetts, and western half of New York (State District Nos. 2, 3, 4, 5, 6, 7, 8).

[10] Acceptable in Connecticut.

[11] Acceptable in Connecticut and all of New York except the northeastern part (State District Nos. 9 and 10).

[12] Desirable in New Hampshire.

[13] Noncount in northeastern New York (State District Nos. 9, 10, and 11), east of Connecticut River in Massachusetts and listed as desirable in Pennsylvania.

[14] Acceptable in Pennsylvania and West Virginia.

[15] Desirable in northeastern New York (State District Nos. 9 and 10).

[16] Noncount in all States except West Virginia.

[17] Desirable in West Virginia.

[18] Desirable in swamps of Connecticut and north of Kanawha River in West Virginia.

[19] Acceptable in New Hampshire.

[20] Desirable in Connecticut and in southwestern New York (State District Nos. 2, 3, 4, and 5).

[21] Acceptable in eastern and southern Connecticut.

[22] Noncount in all States except Connecticut.

STANDARDS FOR THE NEW ENGLAND AND MIDDLE ATLANTIC REGIONS

FOREST TYPE GROUPS

The following forest type groups were recognized:

Spruce-fir
White-red-jack pine
Maple-beech-birch
Oak-hickory (including yellow-poplar and bottomland species)
Loblolly-shortleaf pine (including pitch, Virginia, and other yellow pines)
Oak-pine

SPECIES CLASSIFICATION

The classification of species for the various forest type groups is shown in table 88.

EXISTING STOCKING

Standards for rating existing stocking are given in table 89.

TABLE 89.—*Trees required per acre for full stocking, by tree size and forest type group,*[1] *New England and Middle Atlantic Regions*

Diameter breast high (inches)	Spruce-fir	White pine [2]	Maple-beech-birch	Oak-hickory, oak-pine, and loblolly-shortleaf pine
	Number	*Number*	*Number*	*Number*
Reproduction	1, 000	1, 000	1, 000	1, 000
2	800	800	800	800
4	600	600	600	600
6	560	560	460	400
8	330	330	250	240
10	210	210	175	155
12	150	150	110	115
14	120	115	90	90
16	100	85	70	72
18	80	70	60	60
20		55	50	51
22		46	40	42
24		40	36	36

[1] For convenience in field application, stocking standards for these and all other eastern types were reconstructed in the form illustrated by table 85.
[2] Of the white-red-jack pine type group.

PROSPECTIVE STOCKING

Seed source standards for coniferous species were as follows:

D. b. h. (inches):	Pines required per acre to rate 100 percent for seed-tree requirements [1]: White pine type, light soils (*number*)	Loblolly-shortleaf-pine and oak-pine type groups (*number*)
6	--	30
8	--	20
10	15	17
12	12	13
14	9	10
16+	6	7

[1] For convenience in field application, seed-tree standards for these and all other eastern types where applicable were reconstructed in the form illustrated in table 86.

	Standards for determining prospective stocking, based on proximity to seed source: Distance from seed source (*chains*)	Stocking expected (*percent*)
Spruce-fir type group	0 – 5	100
	5. 1–10	60
	10. 1–20	20
	20+	0
White pine type (light soils)	0 – 2	100
	2. 1– 4	75
	4. 1– 6	50
	6. 1– 8	10
	8+	0
Oak-pine and loblolly-shortleaf pine type groups	0 – 2	100
	2. 1– 6	75
	6. 1– 8	50
	8. 1–10	10
	10+	0

Spruce-Fir Type Group

Credit for prospective stocking was given only if the area was cut less than four growing seasons prior to the examination. Isolated individual trees were not recognized as seed sources. Only residual stands or protected groups or strips of trees containing at least 25 percent spruce or fir trees of seed-bearing character were considered to be seed sources. If seed source was a residual stand, at least 15 spruce or fir seed trees per acre were required.

The standards used for classifying prospective stocking based on proximity to the margin of a group, strip, or stand of seed-bearing trees are given in the preceding tabulations.

White Pine Type

(1) *Heavy soils (natural hardwood sites).* Prospective stocking was not considered on heavy soils. Unless reproduction of desirable species was present before removal of the final overstory, establishment subsequent to cutting was considered problematical. Availability of white pine seed sources on cutover areas on such sites is believed to have doubtful influence on the reproduction established after cutting.

(2) *Light soils (natural pine sites).* Prospective stocking was considered only if the area was cut

less than four growing seasons prior to examination. The standards based on number of seed trees left per acre and those based on proximity to the margin of a group, strip, or stand of seed-bearing trees are given in the preceding tabulations.

Maple-Beech-Birch and Oak-Hickory Type Groups

Prospective stocking was considered only if the area was cut less than four growing seasons prior to examination. Due to prolific seeding and sprouting ability of the species associated with these types, it was considered that the areas would restock fully unless restocking was adversely affected by cull trees, weed trees, herbaceous growth, slash, grazing, deer browsing, etc.

Loblolly-Shortleaf Pine Type Group

Prospective stocking was considered only if the area was cut less than five growing seasons prior to examination. Only pines were accepted as seed trees. The standards based on seed trees and proximity to the margin of a group, strip, or stand of seed-bearing trees are shown in the preceding tabulations. Where seedbeds had been improved by successful prescribed burning, seed-tree requirements were reduced to a minimum of 50 percent of those indicated in the tabulation.

Oak-Pine Type Group

Prospective stocking was considered only if the area was cut less than five growing seasons prior to examination. On good hardwood sites (site index 50+ for oaks or 60+ for sweetgum and yellow-poplar) only seed trees of desirable species were recognized. On poor hardwood sites, only yellow pines were recognized as seed trees. Heavy-seeded hardwoods were not considered as seed trees unless they were within 1 chain of the plot. Prospective stocking standards are shown in the tabulations.

Effect of Felling Age

The standards for the proportion of the mean annual growth at culmination attained at various ages or stump diameters are shown in table 90 for all forest type groups except the oak-pine. In this type group, no felling-age factor was applied to hardwoods if the site index on a cutting area was lower than 50 for oaks or hickory, or lower than 60 for sweetgum or yellow-poplar. The rating was then based entirely on the age of the pines cut, and the standard for loblolly-shortleaf pine (table 90) was used.

On better sites, the rating was affected by the age of both the pines and hardwoods cut. The rating for pines was taken from the standard for loblolly-shortleaf pine and that for hardwood species from the oak-hickory standard.

STANDARDS FOR THE LAKE STATES REGION

Forest Type Groups

The following forest type groups and types were recognized:

Aspen-paper birch	White-red-jack pine
Spruce-fir	Jack pine type
Swamp black spruce-tamarack-type	Maple-beech-birch
	Oak-hickory

Species Classification

The classification of species by type groups and sites is shown in table 91.

Existing Stocking

Table 92 shows the number of trees per acre required for 100-percent stocking.

Prospective Stocking

Aspen-Paper Birch Type Group

During the first 2 years after cutting, the following conditions were required for a classification of "full stocking":

1. Thirty aspen stumps per acre (well distributed over area).
2. Eighty percent of ground area free of brush, heavy sod, cull trees, or other shade.
3. Sandy loam or better soils. If the soil was very light, the examiner made adjustments in line with results in comparable sites in the locality.

Prospective stocking for species other than aspen in this type group was determined by standards for other type groups.

Spruce-Fir Type Group

Other spruce-fir type (upland and swamp phases).—Prospective stocking was considered only if the area was cut less than 5 years prior to examination. Seed trees were recognized only if at least 7 inches d. b. h. for spruce or 5 inches d. b. h. for balsam fir. Twenty such seed trees well distributed over an acre were considered essential to full stocking.

TABLE 90.—*Percentage of mean annual growth at culmination attained at various sizes or ages, by forest type group and size class of products cut, New England and Middle Atlantic Regions*

Stump diameter inside bark (inches)	Spruce-fir type group			Maple-beech-birch type group, all hardwoods	
	Spruce and hardwoods		Balsam fir, all products		
	Sawtimber	Cordwood		Sawtimber	Cordwood
	Percent	*Percent*	*Percent*	*Percent*	*Percent*
6	---	---	40	---	---
7	---	---	60	---	---
8	---	40	80	---	40
9	---	60	90	---	63
10	40	75	100	40	80
11	50	90	---	50	90
12	60	100	---	65	100
13	70	---	---	---	---
14	80	---	---	80	---
15	88	---	---	---	---
16	94	---	---	90	---
17	98	---	---	---	---
18	100	---	---	95	---
20	---	---	---	100	---

Age (years)	White pine type,[1] red and white pines, all products	Oak-hickory type group				Loblolly-shortleaf pine type group, southern pines and southern pine-hardwood type	
		Yellow-poplar and sweetgum		Oak and other hardwoods			
		Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Cord-wood
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
15	---	---	40	---	---	---	---
20	---	---	60	---	---	---	60
25	---	---	75	---	40	30	80
30	40	---	84	---	60	43	95
35	---	40	90	---	72	63	98
40	65	60	95	---	82	80	100
45	---	---	---	---	92	92	---
50	80	80	100	40	96	100	---
60	92	90	---	62	100	---	---
70	98	95	---	80	---	---	---
80	100	100	---	90	---	---	---
90	---	---	---	100	---	---	---

[1] Of the white-red-jack pine type group.

Standards for determining prospective stocking based on proximity to margin of groups, strips, or stands of seed-bearing trees were as follows:

Distance from seed source (chains):	*Stocking expected (percent)*
0–2	100
2–4	80
4–6	60
6–8	40
8–10	20
10+	0

Swamp black spruce-tamarack type.—Prospective stocking was considered for any cutting since January 1, 1947, in the black spruce subtype, but for the tamarack subtype prospective stocking was considered only if cutting was done less than 5 years prior to examination.

Individual trees left standing on recent cutovers were not recognized as seed sources because of their susceptibility to windthrow. The following standard was used for determining prospective

TABLE 91.—*Classification of species according to forest type group and site, Lake States Region*

Species	Aspen-paper birch type group			Spruce-fir type group			White-red-jack pine type group				Maple-beech-birch type group		Oak-hickory type group	
					Other spruce-fir		Jack pine		Red and white pine					
	Site index 60+	Site index 45–60	Site index under 45 [1]	Swamp black spruce-tamarack	Upland	Swamp	Site index 50+	Site index under 50	Site index under 65	Site index 65+	Upland	Lowland	Merchantable height at 60 years, 12 feet or more	Merchantable height at 60 years, under 12 feet
Ash, black	A					A					A	A		
Ash, green	A												A	
Ash, white	D						A				D		D	
Aspen	D	A			A	[2] A	A		A	A	A	A	A	
Balm-of-Gilead	[3] A				[3] A						[3] A	[3] A	[3] A	
Basswood	D				D		A			A	D		D	
Beech											A		A	
Birch, yellow	D				D	[3] A	A			A	D	D	A	
Birch, paper	D	A			A	[2] A	A			A	A	A	A	
Cherry, black	A										A		D	
Elm, American	A					A					A	D	A	
Elm, rock	D					A	A				D	D	A	
Elm, slippery	A					A					A	D	A	
Fir, balsam	D	D		A	D	D	A		A	A	[4,5] A	D		
Hemlock	D				D	A	A			A	D	A		
Hickory													A	
Maple, red	A										A	D		
Maple, sugar	[4] D				[4] D		A			[4] A	[4] D	[4] D	[4] D	
Oak, black							[6] A						A	
Oak, bur	A				A		[6] A				A	A	D	A
Oak, pin							[6] A							A
Oak, north. red	D				D		A			A	D	D	D	A
Oak, white							A						D	
Pine, jack	D	D	D				D	D	D	A				D
Pine, red	D	D	D		D		D	D	D	D				D
Pine, white	D	D	A		D	D	D	A	D	D	D	D		
Spruce, black	D	A		D	D	D	D	A	A	A		D		
Spruce, white	D	D	A	A	D	D	D	A	D	D	D	D		
Tamarack	A			[7] A	A	D								
Walnut, black													D	
White-cedar	A			A	A	D				A	A	A		

A=Acceptable. D=Desirable.

[1] This classification was used for all aspen-paper birch in North Dakota.
[2] Noncount on peat swamps.
[3] Noncount except where it was readily accepted on the market.
[4] Noncount in most of northern Minnesota.
[5] Desirable in northern Minnesota.
[6] Noncount on sites where site index was under 65.
[7] Desirable if tamarack made up more than 50 percent of stand before cutting.

stocking based on proximity to the margin of groups, strips, or stands of seed-bearing trees:

Distance from seed source (chains):	Stocking expected (percent)
0–3	100
3–6	80
6–9	60
9–12	40
12–15	20
15+	0

White-Red-Jack Pine Type Group

Jack pine.—Prospective stocking was considered only if the stand was cut less than 5 years prior to examination. Because seed in slash is very important, it was credited in the rating. The importance of mineral-soil exposure and absence of ground cover also affected the rating. Standards were not specified but were left to the judgment of the examiners.

Red and white pine.—Prospective stocking was considered only if the stand was cut less than 5 years prior to examination. The following standards were used:

Seed trees per acre 12 inches d. b. h. and larger (number):	Stocking expected (percent)
2–4	20
5–7	40
8–11	60
12–15	80
16+	100

No trees less than 12 inches d. b. h. were recognized as seed trees and no prospective stocking considered from seed margins of green timber.

Maple-Beech-Birch Type Group

Prospective stocking was considered only if the stand was cut less than 3 years prior to the examination. Ten seed trees per acre of desirable species not less than 10 inches d. b. h. were credited with producing enough seed to fully restock the area. The following standards, based on proximity to an adjacent seed-bearing timber stand, were used:

Distance from seed source in multiples of tree height:	Stocking expected (percent)
0–1	100
1–2	50
2–3	25
3–4	10
More than 4	0

TABLE 92.—*Trees required per acre for full stocking, by tree size and forest type group, Lake States Region*

Diameter breast high (inches)	Aspen-paper birch type group	Spruce-fir type group	White-red-jack pine type group		Maple-beech-birch type [1] group	Oak-hickory type group
			Jack pine	Red and white pine		
	Number	*Number*	*Number*	*Number*	*Number*	*Number*
Reproduction	1,000	1,000	1,000	1,000	1,000	1,000
2	800	800	800	800	800	800
4	600	600	600	600	600	600
6	360	560	400	500	400	270
8	230	330	260	300	250	180
10	150	210	180	200	175	125
12	110	150	130	140	120	95
14	80	120	100	100	90	71
16	60	100	75	80	70	56
18	48	80	60	62	60	45
20		65		50	50	37
22		50		42	40	30
24		45		35	36	25
26				30	30	
28				26	26	
30				22	22	
32					20	
34					17	
36					15	

[1] Also used for elm-ash-cottonwood stands.

Oak-Hickory Type Group

Prospective stocking was considered only if the stand was cut less than 3 years prior to examination. The standards for judging prospective stocking in relation to number of seed trees per acre are given in table 93. Those based on proximity of the stand to a margin of trees of seed-bearing age are given in the following tabulation:

	Distance from seed source (chains)	*Stocking expected (percent)*
Heavy-seeded species	0–2	100
	2–4	50
	4+	20
Light-seeded species	0–5	100
	5–10	75
	10–20	25
	20+	0

EFFECT OF FELLING AGE

Table 94 shows the felling-age factors used in adjusting the productivity ratings for the various forest type groups.

In rating productivity in the maple-beech-birch type group, no reduction was made for felling age if the cutting removed trees that were principally "acceptable" or "noncount" species and there was a good stocking of reproduction of desirable species on the ground. Where such conditions did not exist, the standards in table 94 were applied.

Felling factors for the various species found in the oak-hickory type group were taken from other type tables which included the species cut or which had similar growth habits.

TABLE 93.—*Relation of expected stocking to number of seed trees per acre in the oak-hickory type group, type of seed, and tree size class, Lake States Region*

Heavy-seeded hardwoods		Light-seeded hardwoods		Stocking expected
12- to 16-inches d. b. h.	17- to 26-inches d. b. h.	12- to 16-inches d. b. h.	17- to 26-inches d. b. h.	
Number	*Number*	*Number*	*Number*	*Percent*
2	1			10
4	2	1		20
6	3	2	1	30
8	4			40
10	5	3		50
12	6	4	2	60
14	7			70
16	8	5		80
18	9	6	3	90
20	10	7	4	100

TABLE 94.—*Percentage of mean annual growth at culmination attained at various ages, by forest type group, site class, and size class of products cut, Lake States Region*

Age (years)	Aspen-paper birch type group,[1] sawtimber	Spruce-fir type group (all products)						
		Balsam fir	White spruce	Northern white-cedar		Swamp black spruce-tamarack		
				Medium sites [2]	Good sites [3]	Good sites	Medium sites	Poor sites
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
20								
25								
30		60						
35	30	75						
40	60	85				50	15	
45	90	95	35					
50	100	100	55		65	85	55	
60			80	55	85	93	80	15
70			95	80	97	100	94	45
80			100	95	100		100	80
90				98				
100				100				100
120								
140								

Age (years)	White-red-jack pine type group						Maple-beech-birch type group					
	Jack pine		Red and white pine				Sugar maple, etc.[5]		Oaks, etc.[6]		Cottonwood	
			Unmanaged		Managed [4]							
	Sawtimber	Cordwood	Sawtimber	Cordwood	Sawtimber	Cordwood	Sawtimber	Cordwood	Sawtimber	Cordwood	Sawtimber	Cordwood
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
20		65										20
25		86								45		60
30		90		40						70	45	80
35	45	98						50		85	75	95
40	55	100	40	80		65		80		94	95	100
45								85		96	99	
50	75		65	95	40	85		90	35	97	100	
60	90		85	100	60	95	40	98	60	100		
70	100						60	99	80			
80			98		85	100	75	100	95			
90							85		98			
100			100		98		90		100			
120					100		97					
140							100					

[1] Cordwood: no deduction for age of cutting.
[2] Medium site is 38 to 55 feet total height at 100 years.
[3] Good site is 55 feet or over in height at 100 years.
[4] A managed stand is one that has been given skillful thinnings or other immediate cuttings.
[5] Includes sugar maple, yellow birch, beech, black ash, and hemlock.
[6] Includes oaks, white ash, green ash, basswood, elm, red maple, and black cherry.

STANDARDS FOR THE CENTRAL REGION

Forest Type Groups

The criteria for rating productivity in the Central Region were based on forest type group and, for one type group, on site also:

Elm-ash-cottonwood
  Bottom-land hardwood
Oak-hickory
  Upland hardwood
    Excellent sites ---------- 90 feet or more at maturity.
    Good sites ---------- 70 to 90 feet at maturity.
    Medium sites ---------- 60 to 70 feet at maturity.
    Poor sites ---------- Less than 60 feet at maturity.
Oak-pine
Loblolly-shortleaf pine (includes Virginia pine)

Species Classification

The classification of species for the various type groups and sites is shown in table 95.

Existing Stocking

Table 96 shows the number of trees per acre required for full stocking.

Prospective Stocking

Hardwood Type Groups

Full credit for the ability of the hardwood forest type groups to restock was given if the logging and associated swamping resulted in stumps mostly of desirable species that sprout prolifically, and if the stumps were of a small enough size to

TABLE 95.—*Classification of species according to forest type group and site, Central Region*

Species	Elm-ash-cottonwood type group—bottomland hardwood type	Oak-hickory type group—upland hardwood type				Loblolly-shortleaf pine and oak-pine type groups [1]
		Excellent sites	Good sites	Medium sites	Poor sites	
Ash	D	D	D			
Aspen			A			
Basswood		D	D			
Beech		A	A	A		
Blackgum		[2] A	A	A		
Buckeye		A	A	A		
Cherry, black		D	D			
Cottonwood	D	A	A			
Cypress	D					
Elms	A	A	A	A		
Hackberry	A	A	A	A		
Hemlock		[3] A	A			
Hickory	A	A	A	A		
Locust, black		A	A	A		
Locust, honey	A					
Maple, red	[4] D	A	A	A		
Maple, sugar		[5] A	[5] A	A		
Oak, black		[3] A	D	D	[4] D	A
Oak, bur		D	D	D		
Oak, chestnut		A	A	D	D	
Oak, pin	[6] A		A	A	A	
Oak, post			A	A	A	
Oak, red	D	D	D	D	A	A
Oak, scarlet		A	A	[3] A	A	A
Oak, white	D	D	D	D	A	A
Pines			D	D	D	D
Redcedar				D	D	A
Sweetgum	D	A	D	A		
Sycamore	D	A	A			
Walnut, black		D	D	A		
Yellow-poplar	D	D	D	D		A

D=Desirable species. A=Acceptable species.

[1] In eastern Kentucky, the classification for upland hardwoods, medium site, was used in lieu of the classification in this column.
[2] Noncount in all States except Kentucky.
[3] Desirable in Kentucky.
[4] Acceptable in Kentucky.
[5] Desirable in eastern Kentucky and northern part of region.
[6] Desirable on tight-soiled pin oak flats.

TABLE 96.—*Trees required per acre for full stocking, by tree size, forest type group, and site, Central Region*

Diameter breast high (inches)	Elm-ash-cottonwood, oak-hickory, and oak-pine type groups				Loblolly-shortleaf pine type group
	Excellent sites [1]	Good sites [2]	Medium sites	Poor sites	
	Number	*Number*	*Number*	*Number*	*Number*
Reproduction	1,000	1,000	1,000	1,000	1,000
2	800	800	800	800	800
4	600	600	600	600	600
6	450	400	360	300	400
8	280	240	220	170	230
10	190	155	145	110	155
12	140	115	100	80	115
14	105	90	80	60	90
16	80	70	60	45	72
18	66	55	46	35	60
20	55	45	38	30	50
22	45	38	31	25	42
24	38	32	26	20	35
26	33	27	----	----	----
28	28	23	----	----	----
30	24	20	----	----	----
32	21	----	----	----	----
34	19	----	----	----	----
36	17	----	----	----	----

[1] This standard was used for most bottom-land hardwood sites and for the best of the upland hardwood sites.

[2] This standard also used for all sites of the maple-beech-birch forest type group and the best of the oak-pine sites.

insure sprouts that would develop into crop trees.

If the logging resulted in large stumps, or if the stumps were of species incapable of sprouting or consisted for the most part of acceptable or noncount species, the rating was then based largely on the adequacy of the seed source.

The standards for individual seed trees and for adjacent margins of seed-bearing stands were identical to the standards used for the oak-hickory type group in the Lake States Region.

Loblolly-Shortleaf Pine Type Group

The standards used for prospective stocking were as follows:

Diameter breast high (inches):	*Average number of pines required per acre to rate 100 percent for seed-tree requirements*
8	20
10	15
12	12½
14	10
16	7½
18+	4½

Distance from seed source (chains):	*Standards for determining prospective stocking, based on proximity to pine seed source*		
	Good seed source (percent)	*Fair seed source [1] (percent)*	*Poor seed source (percent)*
0–2	100	100	30
2–4	100	80	20
4–6	100	40	10
6–8	80	30	5
8–10	40	10	0
10–12	10	5	----
12+	0	0	----

[1] In Kentucky this column only was used.

Classification of adjacent timber stands as a "good," "fair," or "poor" seed source was determined by field examiners on the basis of judgment.

Effect of Felling Age

The felling-age factors showing the effect of cutting trees prior to the culmination of the mean annual growth are shown in table 97 for various species and sites.

TABLE 97.—*Percentage of mean annual growth at culmination attained at various ages, by forest type group and size class of products cut, Central Region*

Age (years)	Oak-hickory type group																	Loblolly-shortleaf pine type group—shortleaf pine [7]			
	Excellent site hardwoods							Good site hardwoods				Medium and poor site hardwoods									
	Oaks, etc.[1]		Basswood, etc.[2]		Sweetgum, elm		Cottonwood [3]	Basswood, etc.[4]		Oaks, etc.[5]		Black oak, redcedar		Scarlet oak, etc. [6]		Other oaks		Site index 60		Site index 70	
	Sawtimber	Cordwood	Sawtimber	Cordwood	Sawtimber	Cordwood	Sawtimber	Sawtimber	Cordwood	Sawtimber	Cordwood	Sawtimber	Cordwood	Sawtimber	Cordwood	Sawtimber	Cordwood	Sawtimber	Cordwood	Sawtimber	Cordwood
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
20		20		70		70			60										50		60
25		45	30	80	15	90	40		75		45		40		40				75		80
30		70	55	87	30	95	60	40	85		60		60		60		40		93	40	95
35		85	65	95	45	98	85	50	90		75		85	30	85		70	46	98	60	98
40	15	95	75	100	60	100	100	60	95		95	40	95	60	95		90	63	100	80	100
45	30	98	80		70			70	99		98	60	100	80	100		95	77		92	
50	45	100	85		80			80	100	40	100	75		90			100	89		100	
55																		96			
60	75		90		90			85		70		90		100		30		100			
70	85		95		95			95		85		100				55					
80	95		100		100			100		96						75					
90	100									100						95					
100																100					

[1] Oaks, sugar maple, beech, walnut, and hickory.
[2] Basswood, yellow-poplar, ash, red maple, sycamore.
[3] No felling-age factors were recognized for cordwood products because of the very early growth culmination of cottonwood for this class of material in the region.
[4] Basswood, yellow-poplar, ash, red maple, sycamore, elm.
[5] Oaks and species other than those listed in 4.
[6] Scarlet oak and hickory in Kentucky.
[7] For hardwood species associated with the pine type, appropriate hardwood standards were used.

STANDARDS FOR THE PLAINS REGION

Lake States criteria were used in the survey of North Dakota, and criteria of the West Gulf Region were applied in the Plains parts of Oklahoma and Texas. The standards given in the following summary were used in South Dakota, Nebraska, and Kansas. For these States, the point system of sampling developed for the West was used.

FOREST TYPE GROUPS

Two forest type groups were recognized:

Oak-hickory
Elm-ash-cottonwood
Cottonwood type

The productivity standards for the oak-hickory and the elm-ash-cottonwood type groups were identical, but they differed for the cottonwood type.

SPECIES CLASSIFICATION

The following species classification was used for all types:

Desirable Species
- Ash
- Hackberry (acceptable in Kansas)
- Oak, bur
- Oak, chestnut
- Oak, red
- Walnut, black

Acceptable Species
- Basswood
- Cottonwood (desirable in cottonwood type)
- Coffeetree, Kentucky
- Elms
- Hickories
- Maple, red
- Mulberry, red
- Redcedar

EXISTING STOCKING

Table 98 shows the standards used to determine existing stocking at each sample point. Seedlings, saplings, and, in some instances, poles were counted if they fell within 1-, 2-, or 4-milacre circular plots, as indicated in the table. Larger trees were counted if they occurred within the maximum distance from the point indicated for each d. b. h. class in the table.

PROSPECTIVE STOCKING

Cutover bottom lands and mixed hardwoods were considered capable of restocking fully if prospective reproduction would be free to grow and the area was not subject to damage by fire or grazing. Under less favorable conditions, the prospective-stocking rating was based on seed source, expected sprouting, amount of area occupied by slash, grass, brush, culls, etc., and damage by grazing or fire.

If 50 percent of the 4-milacre quadrat surrounding the point was free of brush, rock, etc., and if there was an adequate seed source, the point was considered prospectively stocked provided there was no evidence of grazing within the past 5 years. An adequate seed source was considered to be one or more desirable seed trees not more than 2 chains from the point for heavy-seeded species or 5 chains from the point for light-seeded species. If there was a stump of 4 inches or less capable of producing sprouts within 7½ feet of the point and

TABLE 98.—*Trees per acre and maximum distance from point required for full stocking, by tree size, forest type group and type, Plains Region*

Diameter breast high (inches)	Oak-hickory and elm-ash-cottonwood type groups		Cottonwood type	
	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point
	Number	*Feet*	*Number*	*Feet*
Reproduction	1, 000	3. 7	1, 000	3. 7
2	800	4. 1	800	4. 1
4	600	4. 8	600	4. 8
6	400	5. 9	450	5. 6
8	240	7. 6	280	7. 0
10	155	9. 5	190	8. 6
12	115	11. 0	140	9. 9
14	90	12. 4	105	11. 5
16	70	14. 1	80	13. 2
18	55	15. 9	66	14. 5
20	45	17. 8	55	15. 9
22	38	19. 1	45	17. 8
24	32	20. 8	38	19. 1
26	27	22. 7	33	20. 5
28	23	24. 6	28	22. 3
30	20	26. 3	24	24. 0
32			21	25. 7
34			19	27. 0
36+			17	28. 6

no evidence of recent grazing or burning, the point was considered potentially stocked.

EFFECT OF FELLING AGE

Whenever significant clear cuttings were encountered in stands below rotation age, appropriate adjustment factors were recorded according to the standards in table 99.

STANDARDS FOR THE SOUTH ATLANTIC, SOUTHEAST, AND WEST GULF REGIONS

FOREST TYPE GROUPS

The following type groups were recognized:

Loblolly-shortleaf pine (including Virginia pine)
Longleaf-slash pine
Oak-hickory
Oak-gum-cypress
Oak-pine (includes small area of spruce-fir)

SPECIES CLASSIFICATION

The classification of species for the various forest type groups is shown in table 100.

EXISTING STOCKING

A composite table for all forest types was used in the southern TRR regions for determining existing stocking. The corresponding density standard this represents is shown in table 101.

TABLE 99.—*Percentage of mean annual growth at culmination attained at various ages, by forest type group and type, and size class of products cut, Plains Region*

Age (years)	Oak-hickory and elm-ash-cottonwood type groups				Cottonwood type [1]			
	Good site [2]		Poor site [3]		Cottonwood		Other species	
	Saw-timber	Cordwood	Saw-timber	Cordwood	Saw-timber	Cordwood	Saw-timber	Cordwood
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
20						20		
25		45				60		43
30		60		40	45	80		69
35		75		70	75	95		85
40		95		90	95	100	38	95
45		98		95	99		48	100
50	40	100		100	100		58	
60	70		30				73	
70	85		55				84	
80	96		75				91	
90	100		95				95	
100			100				97	
110							98	
120							100	

[1] For sites where total height of mature trees was more than 90 feet. For sites where total height of mature trees was below 90 feet, standards for the oak-hickory and elm-ash-cottonwood type groups were used.

[2] Good sites=total height of mature trees 70 feet or more.

[3] Poor sites=total height of mature trees less than 70 feet.

TABLE 100.—*Classification of species according to forest type group, South Atlantic, Southeast, and West Gulf Regions*

Species	Loblolly-shortleaf pine	Longleaf-slash pine	Oak-hickory	Oak-gum-cypress	Oak-pine [1]	Species	Loblolly-shortleaf pine	Longleaf-slash-pine	Oak-hickory	Oak-gum-cypress	Oak-pine [1]
Ash			D	D	D	Oak, overcup				A	
Basswood			D		A	Oak, pin					A
Birch			A		A	Oak, post				A	
Blackgum				A		Oak, northern, red		A	D	D	D
Butternut			A		A	Oak, southern, red		A	A	[3] A	D
Cherry, black			A		[2] D	Oak, scarlet	A				A
Cottonwood				D		Oak, shingle					A
Cucumbertree				D	A	Oak, Shumard				D	
Cypress, bald		A		D		Oak, water				[4] D	A
Cypress, pond		A		A		Oak, white	A	A	D	[3] D	D
Dogwood			A			Oak, willow				[4] D	
Elm			A	A	A	Pecan				A	
Fir, Fraser					[2] D	Persimmon				A	
Hackberry				A		Pine, loblolly	D	A	D	D	D
Hemlock, eastern			A		[2] D	Pine, longleaf	A	D	D		
Hemlock Carolina			A		[2] A	Pine, pitch			A		D
Hickory				A		Pine, pond	A	A			
Locust			A	A	A	Pine, sand		A			
Magnolia			D	D		Pine, shortleaf	D	A	D		D
Maple, red	A		A	A	A	Pine, slash	A	D			
Maple, silver			A	A	A	Pine, spruce	A	A		D	
Maple, sugar			D		[2] D	Pine, Virginia	[5] A		A		D
Mulberry				A		Pine, white			D		D
Oak, black	A		D	[3] A	D	Redcedar					D
Oak, bur				A		Spruce, red					[2] D
Oak, cherrybark		A	D	D	D	Sweetbay				A	
Oak, chestnut			A		D	Sweetgum			D	D	D
Oak, chinquapin			D		D	Sycamore				A	
Oak, cow				D		Tupelo				A	
Oak, diamondleaf				[3] A		Walnut, black			D		D
Oak, Nuttall				[4] D		Willow, black				[6] D	
						Yellow-poplar	A		D	D	D

A=Acceptable species. D=Desirable species.

[1] The small area of spruce-fir in the southern regions was included with oak-pine.

[2] Pertains to classification of this species in the spruce type.

[3] Desirable on good sites.

[4] A desirable tree must have at least a No. 2 log or better or be capable of producing such. On poor sites rated as acceptable or noncount depending on condition of tree.

[5] Desirable in the upper Piedmont or mountain foothills.

[6] Noncount except along Mississippi River.

TABLE 101.—*Trees per acre required for full stocking, all type groups, by tree size, South Atlantic, Southeast, and West Gulf Regions*

Diameter breast high (inches)	Trees per acre	Diameter breast high (inches)	Trees per acre
	Number		*Number*
Reproduction	1,000	20	51
2	800	22	42
4	590	24	36
6	400	26	31
8	240	28	27
10	155	30	24
12	115	32	21
14	90	34	19
16	72	36	17
18	60	38	15

PROSPECTIVE STOCKING

Loblolly-Shortleaf Pine and Longleaf-Slash Pine Type Groups

Standards for prospective stocking based on seed trees and proximity to a seed source consisting of a group, strip, or stand of seed-bearing trees were as follows:

D. b. h. (inches)	*Average number of pines required per acre to rate 100 percent for seed-tree requirements* — *Longleaf-slash pine type group—longleaf and slash pine (number)*	*Loblolly-shortleaf pine type group—all pines except longleaf and slash (number)*
10	12	15½
12	10	12½
14	6	10
16	4	7½
18	4	4½

	Prospective stocking, based on proximity to seed source	
	Distance from seed source (chains)	*Stocking expected (percent)*
Longleaf pine	0–2	100
	2–3	90
	3–4	70
	4–5	50
	5–6	30
	6+	0
Other southern pines	0 –2½	100
	2½–3½	90
	3½–4½	70
	4½–5½	50
	5½–6½	30
	6½–7½	10
	7½+	0

Oak-Hickory, Oak-Gum-Cypress, and Oak-Pine Type Groups

Because of the prolific sprouting and seed-bearing habits of species associated with these type groups, it was assumed that under normal conditions satisfactory reproduction would become established unless culls, weed trees, grazing, etc., prohibited it.

Effect of Felling Age

Table 102 lists the standards used in the southern TRR regions for all type groups except the oak-pine.

In the oak-pine type group on sites that were primarily pine sites, a felling-age factor was applied to pines (table 102) that were cut prematurely, but no felling-age factor was applied to hardwoods that were cut. Thus, the productivity rating was not lowered if the cutting of young hardwoods served to stimulate regeneration or growth of pines.

On sites in the oak-pine type group that were primarily hardwood sites, hardwood felling factors were applied where the cutting of young hardwoods occurred. The hardwood standards of table 90 were used.

TABLE 102.—*Percentage of mean annual growth at culmination attained at various ages, by forest type group and size class of products cut, South Atlantic, Southeast, and West Gulf Regions*

Age (years)	Loblolly-shortleaf pine [1]				Longleaf-slash pine [2]			Oak-hickory				Oak-gum-cypress (all species)	
	Loblolly pine		Shortleaf pine [3]		Longleaf pine		Slash pine, [4] saw-timber	Oak and hickory		Sweetgum and yellow-poplar			
	Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Cord-wood		Saw-timber	Cord-wood	Saw-timber	Cord-wood	Saw-timber	Cord-wood
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
10		42											
15		66		48		48					40		
20	33	80		66	32	67	36				60		60
25	57	90	28	82	45	81	60		43		75		75
30	75	96	43	94	58	89	79		62		84		84
35	88	100	63	98	70	95	91	32	74	40	90	44	90
40	96		80	100	78	98	100	43	85	60	95	68	95
45	100		92		84	100		54	92				
50			100		94			64	100	80	100	81	100
55					98			72					
60					100			79		90		90	
65								84					
70								89		95		94	
75								91					
80								94		100		98	
85								97					
90								100				100	

[1] When loblolly pine was the predominating species in the stand, the loblolly standards were used. When shortleaf or other southern pines predominated, the shortleaf standards were used.

[2] When longleaf pine was the predominating species in the stand, the longleaf standards were used. When slash pine predominated, the slash pine standards were used.

[3] These standards were used for Virginia pine and other southern pines.

[4] No deduction for cordwood.

STANDARDS FOR THE PACIFIC NORTHWEST, CALIFORNIA, AND COASTAL ALASKA REGIONS

Forest Type Groups

These three regions are treated as a group in this summary because of similarities in the standards used. The timber type groups recognized for each region were as follows:

California

Douglas-fir
Ponderosa pine
Western white pine
Fir-spruce
Redwood

Pacific Northwest

Douglas-fir
Ponderosa pine
Western white pine
Fir-spruce
Hemlock-Sitka spruce
Lodgepole pine
Hardwoods
Western larch

Alaska

Hemlock-Sitka spruce

Species Classification

The classification of species for the various forest type groups is shown in table 103.

Existing Stocking

Table 104 summarizes the standards used to determine existing stocking at observation points in the Pacific Northwest Region. Points were considered stocked if crop trees of the indicated age or size were found within the distances shown in the table.

Integration of the stocked-quadrat method with the point-sampling system for determination of stocking of reproduction in the West warrants special discussion. The following tabulation relates the entries in tables 104 and 105 for seedlings

Table 103.—*Classification of species according to forest type group,[1] Pacific Northwest, California, and Coastal Alaska Regions*

Species	Douglas-fir			Ponderosa pine				Hemlock-Sitka spruce		Western white pine		Fir-spruce			Western larch, Washington and Oregon	Redwood, California	Hardwoods
	Washington and Oregon		California	California		Washington and Oregon		Washington and Oregon	Alaska	Washington and Oregon	California	Washington and Oregon		California			
	East side	West side		East side	West side	East side	West side					East side	West side				
Alder, red		A						A									
Ash, Oregon																	
Birch, white									[2] D								[3] A
California-laurel																	[3] A
Cottonwood, black		A							D								
Douglas-fir	D	D	D	A	D	D	D	D		D	D	D	D	D	D	D	
Fir, alpine												A	A				
Fir, grand		[4] A						A									
Fir, lowland white																A	
Fir, noble		D										D					
Fir, Pacific silver		[4] A						D					D				
Fir, Shasta red												D	D	D			
Fir, white	A		A	A	A	A	A			A	A	D		D	A		
Hemlock, mountain									A			D	D				
Hemlock, western		[5] D	A					D	D				D			A	
Incense-cedar	A	A	A	A	A	A	A				A			A			
Larch, western	D					A									D		
Maple, bigleaf		A						A									
Oak, Oregon white																	[3] A
Pine, Jeffrey				D	D						D			D			
Pine, lodgepole	A					A			A			A	A		A		
Pine, ponderosa	D	D	D	D	D	D	D			D	D			D	D		
Pine, sugar	[6] D	[6] D	[7] D	[7] D	[7] D	[6] D	[6] D			[6] D	[7] D			[7] D			
Pine, western white	A	A								D		D	D		D		
Port-Orford-cedar		D															
Redwood			D													D	
Redcedar, western		[5] D						D	A								
Spruce, black									A								
Spruce, Engelmann						A						D	A		D		
Spruce, Sitka								D	D							D	
Spruce, white									[2] D								
Tanoak		A															A
Yellow-cedar, Alaska									A				A				

[1] Lodgepole pine type group: All species classified as desirable.
[2] For some localities these species are desirable. Example: Pure stands of ash within overflow areas; pure stands of oak in Willamette Valley; pure patches of California laurel.
[3] On the Kenai Peninsula of the Coastal area.
[4] These species were classified as desirable when found on areas ecologically suited to them.
[5] These species were classified as acceptable when found on sites which were severe because of lack of moisture caused by shallow soil or exposure.
[6] Sugar pines and western white pines outside of blister rust control areas were not counted as crop trees unless they were 12 inches d. b. h. or larger and free of blister rust stem cankers.
[7] Outside of blister rust control zones, sugar pines under 6 inches d. b. h. on low rust-hazard areas, 12 inches d. b. h. on medium rust-hazard areas, and 20 inches d. b. h. on high rust-hazard areas were considered noncount trees. Sugar pines bearing rust cankers were not counted as crop trees.

and saplings to conventional measures by the stocked-quadrat method:

Entries from table 104

Minimum trees per acre (number)	*Maximum distance from point (feet)*	*Equivalent minimum of trees per quadrat required for a stocked point (number)*
1,000	3.7	1 per 1-milacre quadrat.
750	7.4	3 per 4-milacre quadrat.
500	7.4	2 per 4-milacre quadrat.
250	7.4	1 per 4-milacre quadrat.

An interpretation of the entries in table 104 can be illustrated by (1) observing that the entries for established seedlings under 6 inches tall in the western white pine type show a minimum of 500 trees per acre and a point distance of 7.4 feet; (2) reference of these entries to the tabulation above shows that at least 2 established seedlings less than 6 inches tall must be present on a 4-milacre quadrat (circular plot having a 7.4-foot radius) before the observation point (or center of the quadrat) is considered stocked.

The standards of table 104 were applied in California with the following adaptations or additions:

1. For the Douglas-fir type group, existing stocking of seedlings, saplings, and small poles was determined by the following:

Size class of tree:	*Minimum trees per acre (number)*	*Maximum distance from point (feet)*
Less than 6 inches high	500	7.4
6 inches high to 9 inches d. b. h.	250	7.4

2. For the ponderosa pine type group east of the Sierra summit, the standards of table 104 for Site Index 80 were applied.

3. For the ponderosa pine, western white (and sugar) pine, and fir-spruce type groups west of the Sierra summit, the standards in table 104 for the western white pine were applied.

4. Table 105 presents the standards for the redwood type group.

In Coastal Alaska, the standards used for hemlock-Sitka spruce were identical to those used for the corresponding type group in the Pacific Northwest (table 104).

Prospective Stocking

Douglas-Fir and Other Type Groups West of the Cascade Summit in the Pacific Northwest

The standards for prospective stocking discussed here were applied to the Douglas-fir, fir-spruce,

TABLE 104.—*Minimum number of trees per acre and maximum distance from observation point used in classifying existing stocking in the Pacific Northwest Region, by forest type group and site index*

Age or size of established seedling and crop tree d. b. h.	Douglas-fir, larch, hemlock-spruce, fir-spruce, and hardwoods		Ponderosa pine: Site index 60		Ponderosa pine: Site index 80		Ponderosa pine: Site index 100		Western white pine		Lodgepole pine	
	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point
	Number	*Feet*	*Number*	*Feet*	*Number*	*Feet*	*Number*	*Feet*	*Number*	*Feet*	*Number*	*Feet*
Under 2 years	750	7.4										
2 yrs. to 9 in. d. b. h	250	7.4										
4 in. high to 5 in. d. b. h											1,000	[1] 3.7
Under 6 in. high			500	7.4	500	7.4	500	7.4	500	7.4		
6 in. high to 8 in. d. b. h			250	7.4	250	7.4	250	7.4				
6 in. high to 10 in. d. b. h									250	7.4		
6 in. d. b. h											653	4.6
7											479	5.4
8											367	6.2
9			190	8.5	215	8.0	250	7.4			290	6.9
10	223	8.0	154	9.5	174	8.9	209	8.1			235	7.7
12	168	9.2	107	11.4	121	10.7	145	9.7	166	9	163	9.2
14	133	10.3	79	13.3	89	12.5	107	11.4	122	11	120	10.8
16	108	11.4	60	15.2	68	14.3	82	13.0	93	12	92	12.3
18	90	12.5	48	17.1	54	16.1	64	14.7	74	14	72	13.8
20	76	13.6	39	19.0	44	17.8	52	16.3	60	15	59	15.3
22			32	20.9	36	19.6	43	17.9	41	18		
24	58	15.6	27	22.8	30	21.5	36	19.5	30	21		
26			23	24.7	26	23.1	31	21.2	23	25		
28	46	17.5	20	26.6	22	25.1	27	22.8	18	28		
30			17	28.5	19	27.0	23	24.4	11	31		
32	36	19.2	15	30.4	17	28.6	20	26.1				
34			13	32.2	15	30.8	18	27.7				
36	30	20.8	12	34.1	13	32.6	16	29.3				
38			11	36.1	12	34.0	14	31.0				
40	25	22.0	10	38.0	11	35.5	13	32.6				
42+			7	44.6	8	41.6	9	38.2				

[1] Overstocking was considered the equivalent of nonstocking under the following conditions: (a) 20 or more seedlings 4 inches to 12 inches high per milacre; (b) 10 or more trees 12 inches tall to 1 inch d. b. h. per milacre quadrat.

TABLE 105.—*Trees per acre and maximum distance from observation point used in classifying existing stocking in the redwood forest type group, California Region*

Tree size	Minimum trees per acre	Maximum distance from observation point
	Number	*Feet*
Under 6 inches high	500	7.4
6 inches high to 12 inches d. b. h.	250	7.4
14 in. d. b. h.	234	8
16	179	9
18	141	10
20	114	11
24	80	13
28	58	15
32	45	18
36	35	20
40	29	22
50	18	28
60+	13	33

western larch, and hemlock-Sitka spruce type groups, and under some situations to the western white pine type group, in the Pacific Northwest Region. They were applied in the western white pine type group when the species associated with western white or sugar pine were representative of the type groups just mentioned. If the species associated with western white pine or sugar pine were representative of the ponderosa pine type group, standards for that type group were applied. In neither situation was western white or sugar pine considered as a seed source if the area under examination was located outside blister rust control zones.

The factors affecting prospective stocking in these type groups were (1) adequacy of seed source, (2) condition of seedbed, and (3) slope and exposure. At each observation point not stocked, the adequacy of seed source was examined and given a numerical rating ranging from 0 to 4. Seedbed condition was assigned a rating of 0 to 3, and slope and exposure was given a rating of 1 to 3 depending on the degree of severity. These 3 separate ratings were then added together and if the sum was 7 or more the point being examined was classed as "stocking in prospect"; if the total amounted to less than 7, the point was recorded as "stocking not in prospect." Any point with a zero seed source or a zero seedbed rating was classed as "stocking not in prospect" regardless of the rating assigned the other two factors.

Seed-source standards.—The basis for classifying seed source is summarized in table 106. The second and third columns of this table show the seeding distances considered effective in clearcut areas where the seed source consists of surrounding or adjacent timber. Columns 4 to 7 show the relative effectiveness attributed to seed trees at varying distances. The last column of table 106 shows the number of first-year seedlings considered necessary to indicate prospects of successful future stocking. Such seedlings, less than 1 year old, have such a high mortality rate that they were not judged to constitute satisfactory standards for existing stocking. However, their presence attests to the fact that seed reaches the point locality.

In applying table 106, the rating for "distance to timber edge" was based on the distance to the nearest timber edge, or, if two or more edges were present, on the sum of the ratings for distance to the two nearest timber edges. If, in addition, seed trees and first-year seedlings were present, the rating value for seed from these sources was added to that for "distance to timber edge." Short timber, i. e., timber less than 150 feet tall, was required, in the judgment of the field examiner, to be of seed-bearing size. In no case was a total rating of seed source—either separately or in combination with timber edge, two nearest timber edges, seed trees or first-year seedlings—given a value of more than 4.

TABLE 106.—*Classification of seed sources for the Douglas-fir and other type groups west of the Cascade summit in the Pacific Northwest*

Rating value	Distance from point to timber edge		Number of standard seed trees by tree-height distance class from point				First-year seedlings on 4-milacre plot
	Tall timber (150+ feet)	Short timber (under 150 feet)	0–1	1–2	2–3	3–4	
	Chains	*Chains*	*Number*	*Number*	*Number*	*Number*	*Number*
4	0–10	0–5	4	11+	32+	95+	----------
3	11–20	6–10	3	8–10	23–31	68–94	3
2	21–25	11–15	2	5–7	14–22	41–67	2
1	26–40	16–25	1	2–4	5–13	14–40	1
½	----------	----------	----------	1	2–4	6–13	----------
0	41+	26+	0	0	0	0	0

Seed-tree classification.—The seed-tree data in table 106 refers to standard seed trees. For seed trees above standard, corresponding rating values of column 1 were multiplied by 1½; for substandard seed trees, the ratings were multiplied by ½.

A standard seed tree, as referred to in table 106, was required to meet the general seed-tree definition and in addition to be 12 inches or larger in d. b. h. if hemlock, cedar or spruce, or 18 inches or larger in d. b. h. if of other species, including Douglas-fir; it was also required to have a live crown length equal to ⅙ to ⅓ of total tree height. Seed trees considered above standard met the above specifications but, in addition, had a live crown length more than ⅓ of total tree height.

Substandard seed trees were recognized as trees of seed-bearing size and age that did not meet d. b. h. or crown requirements of standard seed trees but did meet the general seed-tree definition in other respects.

Seedbed condition.—The basis for classifying seedbed conditions for the Douglas-fir and other type groups west of the Cascade summit in the Pacific Northwest is summarized as follows:

Rating value	*Seedbed condition on a 4-milacre quadrat*
3 (Good)	(a) 50 percent or more of surface favorable for seedling establishment and growth, or
	(b) 2 seedlings less than 2 years old and free to grow.
2 (Fair)	(a) 20 to 50 percent of surface favorable for seedling establishment and growth, or
	(b) 1 seedling less than 2 years old and free to grow.
1 (Poor)	(a) Less than 20 percent favorable for seedling establishment and growth, or
	(b) 1 or more seedlings less than 2 years old in a questionable position for normal development.
0 (Very poor)	*Not likely to restock.* A rating of zero resulted in classing the point as "no stocking in prospect," regardless of the value assigned in the rating of other factors.

The judgment and experience of local field examiners in interpreting the classification of seedbed conditions was supplemented by the following guides:

Favorable seedbed.—Uncompacted mineral soil is basic for ideal seedbed conditions. In addition to receptive soil, the following surface conditions are favorable: (1) A light, vegetative shade of approximately 20 percent (below and above 20 percent density cover conditions become progressively less favorable), and (2) dead shade from logs, stumps, and light slash.

Unfavorable.—Generally the following conditions are indicative of a zero rating for seedbed conditions: (1) Perennial grasses occupying 80 percent or better of the quadrat; (2) herbaceous cover using 80 percent or more of the area (includes overhead shade as well as stem and root competition); (3) accumulation of debris, duff, rotten wood, etc., which are known to be unfavorable for the species rated; and (4) when noncount species dominate the 4-milacre plot.

Slope and exposure.—The basis for classifying slope and exposure conditions for type groups west of the Cascade summit in the Pacific Northwest follows:

Rating value	*Plot condition*
3 (Good)	Slope and exposure not a factor in seedling survival and development.
2 (Fair)	Survival of seedlings questionable during periods of dry weather.
1 (Poor)	Conditions difficult for seedling survival—such as dry, exposed south and southwest slopes which approach 45 percent, and exposed hard compact surfaces.

Although slope and exposure were not considered limiting factors for seed germination, they were considered to have a pronounced effect on seedling survival. South and southwest slopes that approximate a gradient of 45 percent present the most unfavorable conditions. On the other hand, north and northeast slopes that approximate 45 percent appear to be the most favorable. From this it was assumed that level land—gentle slopes up to 20 percent for northwesterly and southeasterly exposures—would approach the midway point, or average conditions for seedling establishment and survival.

Douglas-Fir Type Group in California

Prospective stocking was estimated by a system similar to that used in the Pacific Northwest, i. e., by giving weighted ratings to seed source and seedbed, and to slope and exposure.

Seed-source standards.—The basis for rating seed source in California for the Douglas-fir type group follows:

Rating value	*Number of tree heights from timber edge*	*Supplemental allowance*
4 (Good)	0 to 3	A value of 1 was allowed for each seed tree within one tree height of point. Exceptionally good seed trees were given a value of 2. Outside of blister rust control areas, sugar pines were not counted as seed trees.
3 (Fair)	4 to 5	
2 (Poor)	6 to 7	
0	over 7	

As in the Pacific Northwest, no combined rating of seed source was given a total value of more than 4, and any point with a "zero" rating for seed source was classed as "no stocking in prospect."

Seedbed—slope and exposure.—The data used for rating these factors were the same as those used for the Douglas-fir type group in the Pacific Northwest (see discussion immediately preceding).

Other Type Groups in the Pacific Northwest and California Regions

Seed-source standards.—Seed sources judged adequate for the ponderosa and lodgepole pine type groups in the Pacific Northwest, and for the ponderosa, western white pine, fir-spruce, and redwood forest type groups in California, when in combination with favorable seedbed conditions, are summarized as follows:

Forest type group and region	Maximum effective seeding distance of scattered seed trees: Diameter breast high (inches)	Distance (feet)	Maximum effective seeding distance from timber edge
East side ponderosa pine in California; all ponderosa pine in Pacific Northwest.	12 to 16 18 to 24 26+	40 50 70	Two tree heights from stands containing a fair proportion of trees 12 inches in d. b. h. and larger that meet the seed-tree definition.
West side ponderosa pine, western white pine, and fir-spruce in California.	18 to 24 26+	50 70	Two tree heights from stands containing a fair proportion of trees 18 inches in d. b. h. and larger that meet the seed-tree definition.
Redwood	--------	[1] 60	Two tree heights from stands of mature timber.
Lodgepole pine	6+	[2]	Two tree heights.

[1] Must be capable of bearing seed. Fire columns were not counted as seed bearers until after 10 years of new crown growth.

[2] Two or more seed trees within one tree height of point were considered an effective seed source.

Seedbed condition.—Standards for favorable seedbed conditions in the remaining type groups of these two regions were as follows:

Ponderosa pine type group. The seedbed was considered favorable on Site III (Index 84) and better when at least 25 percent of the 4-milacre quadrat surrounding the observation point was free of brush, sod, or other limiting cover and showed evidence of scarification from logging or other reduction of competition, and the area surrounding the quadrat contained regeneration established at intervals not exceeding 10 years. The standard for poorer sites was the same except that 50 percent of the surrounding quadrat was required to be free of brush, sod, or other limiting cover.

Unstocked sample points in the ponderosa pine type group which were supplied with the minimum sources of seed described in the preceding tabulation, and on which the above seedbed conditions prevailed, were classed as "stocking in prospect." If either the seed source or seedbed were inadequate by these standards, the point was classed as "stocking not in prospect."

Western white pine (sugar pine) and fir-spruce type groups. Unstocked points supplied with at least the minimum seed source described in the preceding tabulation and with seedbed conditions described above as adequate for ponderosa Site III and better were classed as "stocking in prospect." Otherwise they were classed as "stocking not in prospect."

Redwood type group. Unstocked points supplied with at least the minimum seed source described in the preceding tabulation were classed as "stocking in prospect" if the 4-milacre plot surrounding the point had been scarified or had ground competition significantly reduced by logging and was at least 60 percent free of perennial grasses, dense to moderately dense herbaceous growth, overtopping shrubs, and noncrop trees.

Lodgepole pine type group. Unstocked points having at least the minimum seed source described in the preceding tabulation were classed as "stocking in prospect" if the milacre plot surrounding the point was at least 50 percent free of brush, sod, or other limiting cover. Otherwise the points were classed as "stocking not in prospect."

Hemlock-Sitka Spruce Type Group in Coastal Alaska

Determination of prospective stocking was based upon the sum of ratings for seed source and for seedbed condition. If this sum was 5 or greater, the point was classed as "stocking in prospect." If the sum was 4 or less, the point was classed "no stocking in prospect."

Seed source standards.—The basis for rating seed source in Coastal Alaska is summarized below:

Rating value:	Number of tree heights from timber edge
4 (Good)	0 to 4
3 (Fair)	5 to 8
2 (Poor)	9 to 11
0	11+

In addition to the values for distance to timber edge, a value of 1 was allowed for each seed tree within one tree height of a sample point in Alaska. Exceptionally good seed trees within this distance were given a value of 2. In no case was a combined rating of seed source given a total value of more than 4.

Seedbed condition.—The seedbed standards used are shown on page 694, and the procedure and methods of rating were the same as those used for type groups west of the Cascade summit in the Pacific Northwest Region.

Effect of Felling Age

In the Pacific Northwest and California Regions during early stages of the survey, calculations of felling-age effects were completed in the field by each examiner. Later, field examiners recorded

the data necessary for the calculations which were then completed in the Washington Office of the Forest Service following the procedures and tabular guides outlined in the criteria for the two regions. Table 107 presents the factors applied for determining felling-age effects.

West Coast Supplementary Study

For all of the area in Washington, Oregon, and California sampled after March 12, 1954, data supplementary to that required by standard procedures were recorded. These data were as follows:

1. Felling age of trees cut was recorded at each examination point, regardless of stand age or type of cutting.
2. At each observation point, information was recorded on forest type, site-quality class, and whether clear cutting or partial cutting had been applied.
3. For points recorded as nonstocked, the reasons for lack of existing and prospective stocking were recorded.
4. The tree species that stocked each examination point before cutting as well as the species that stocked the point at time of examination were both recorded.

These supplemental records were taken on about 95 percent of the forest area sampled in Washington and Oregon and on about 35 percent of the area sampled in California. The results are presented in the section "Productivity of Recently Cut Lands," page 263, along with the results of the standard study.

STANDARDS FOR THE NORTHERN ROCKY MOUNTAIN REGION

Forest Type Groups

The following forest type groups were recognized:

- Ponderosa pine
- Western larch
- Douglas-fir
- Fir-spruce
- Lodgepole pine
- Western white pine
  - Inside blister rust control units
  - Outside blister rust control units
- Hardwoods
  - Aspen

Species Classification

The species classification, by type group and locality, is shown in table 108.

Existing Stocking

Table 109 shows the standards used to determine existing stocking at each point. Seedlings,

TABLE 107.—*Percentage of mean annual growth at culmination attained at various ages, by forest type group [1] and size class of products cut, Pacific Northwest and California Regions*

Age (years)	Douglas-fir, hemlock-Sitka spruce, and western white pine (Pacific Northwest and California)[2]					Ponderosa pine and western larch (Pacific Northwest)				Ponderosa pine (California), saw logs [4]	
	Saw logs [3]				Cordwood, all sites	Saw logs [4]			Cordwood, all sites	East side [7]	West side [8]
	Site I [5]	Site II	Site III	Site IV and V		Site [6] II and III	Site IV	Site V and VI			
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
20					18				--		
30	25	10			50	10			25		
40	56	35	19		78	28	7		57		41
50	79	64	41	20	92	47	20		80	34	61
60	91	82	66	41	99	64	38		93	52	76
70	97	92	82	60	100	77	54	10	96	68	86
80	100	98	92	75		86	68	17	100	79	93
90		100	98	86		92	79	26		88	97
100			100	93		96	88	34		93	99
110				97		99	93	43		97	100
120				99		100	97	52		99	
130				100			99	62		100	
140							100	71			
150								80			
160								86			
170								92			
180								100			

[1] Factors for felling age were not applied in the type groups not shown here.

[2] For Douglas-fir in California, the factors for Site Index III only were used.

[3] International rule, ¼-inch kerf.

[4] Scribner rule.

[5] Based on site classification in U. S. D. A. Tech. Bul. 201.

[6] Based on site classification in U. S. D. A. Tech. Bul. 630.

[7] Standards where site index was 98 feet or less at 100 years.

[8] Standards where site index was greater than 98 feet at 100 years.

TABLE 108.—*Classification of species according to forest type group,*[1] *Northern Rocky Mountain Region*

Species	Western white pine: Inside blister rust control units	Western white pine: Outside blister rust control units	Ponderosa pine	Larch	Douglas-fir	Spruce-fir: Low elevation western Montana and northern Idaho	Spruce-fir: Region-wide [2]	Lodgepole pine: Low elevation western Montana and northern Idaho	Lodgepole pine: High elevation western Montana and northern Idaho	Lodgepole pine: Southern Idaho and Wyoming, west of Divide	Lodgepole pine: Wyoming, east of Divide	Ponderosa pine (Black Hills)
Douglas-fir	A	D	A	A	D	A	A	D	A	D		
Fir, alpine							[3] A		[3] A	A	A	
Fir, grand	A	D		A	A	A				A		
Hemlock, western	[4] A											
Larch, western	A	D	D	D	D	[5] D	A	D		D		
Pine, lodgepole	A	A	A	A	A	A	D	A	D	D	D	
Pine, ponderosa	A	A	D	A	D			D		D		D
Pine, western white	D	[6] D	[6] A	[6] A	[6] A	[6] D		[6] A				
Redcedar, western	A	D	A	A	A	D						
Spruce, black hills												A
Spruce, Engelmann	A	D	A	D	A	D	D	A	A	D	D	
Hardwoods	[7] A	[7] A										

A=Acceptable. D=Desirable.

[1] Aspen type; all species in type were desirable.
[2] In southern Idaho and in Wyoming, west of Continental Divide, any species of marketable quality in the immediate locality, except limber and whitebark pine, was considered desirable.
[3] Considered acceptable only where reserved for watershed protection.
[4] Considered acceptable where reserved for shade in Ribes control. Otherwise, noncount.
[5] On moist areas near stream bottoms and meadows where water is close to the ground surface, larch was classified as acceptable because in such situations it suffers from disease.
[6] Western white pine under 12 inches d. b. h. was not counted outside of blister rust protection units because survival in such situations is highly questionable. When trees over 12 inches d. b. h. were found, they were classified as shown in the table.
[7] Cottonwood was considered acceptable in localities where it was being utilized; otherwise, noncount.

TABLE 109.—*Minimum number of trees per acre and maximum distances from observation point used in classifying existing stocking, by type group, Northern Mountain Region*

Age or size of established seedling or sapling and crop tree d. b. h.	Ponderosa pine, western larch, and Douglas-fir type groups [1]		Spruce-fir type group (high elevation, Montana and northern Idaho)		Spruce-fir (low elevation western Montana, Idaho, and western Wyoming) or western white pine type groups		Lodgepole pine type group [1]		Ponderosa pine type group (Black Hills)		Hardwoods type group—aspen type	
	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point
	Number	*Feet*	*Number*	*Feet*	*Number*	*Feet*	*Number*	*Feet*	*Number*	*Feet*	*Number*	*Feet*
1 year old to 2.5 in. d. b. h.									1,000	[2] 3.7	1,000	3.7
1 year old to 0.5 ft. high	1,000	5.3	1,000	5.3								
1 year old to 4.5 in. d. b. h.					1,000	3.7	1,000	[2] 3.7				
0.5 ft. high to 4.5 in. d. b. h.	500	5.3	500	5.3								
4.6 in. to 8.5 in. d. b. h.	250	7.4										
4.6 in. to 9.5 in. d. b. h.			250	7.4	500	5.3						
1 in. d. b. h.											900	3.9
2											800	4.1
3									800	4.2	700	4.5
4									680	4.5	600	4.8
5							941	3.8	555	5.0	440	5.7
6							653	4.6	435	5.7	360	6.2
7							479	5.4	325	6.5	280	7.1
8							367	6.2	220	7.9	230	7.7
9	215	8.0					290	6.9	185	8.7	180	8.8
10	174	8.9	202	8.3	278	7.0	235	7.7	155	9.5	150	9.6
12	121	10.7	141	9.9	194	8.5	163	9.2	125	10.5	110	11.2
14	89	12.5	103	11.6	143	9.9	120	10.8	90	12.4	80	13.2
16	68	14.3	79	13.2	109	11.3	92	12.3	55	15.9	60	15.2
18	54	16.1	62	14.9	86	12.7	72	13.8	46	17.4	48	17.0
20	44	18.1	50	16.6	70	14.1	59	15.3	38	19.1		
22	36	19.6	43	18.2	58	15.5			30	21.5		
24	30	21.5	35	19.8	49	16.9						
26	26	23.1	30	21.5	41	18.3						
28	22	25.1	25	23.2	36	19.7						
30	19	27.0	22	24.8	31	21.1						
32	17	28.6	20	26.5	27	22.5						
34	15	30.3	17	28.2	24	23.9						
36	13	32.6	16	29.8	22	25.4						
38	12	34.0										
40	11	35.5										
40+	8	41.6										

[1] Understory larch and Douglas-fir trees and lodgepole pine that occurred in the immediate vicinity or within 40 feet of mistletoe-infected overstory trees were not counted.

[2] Points were considered seriously overstocked and disqualified from the count when the following conditions prevailed: (a) 20 or more seedlings 1 year old to 1 foot high per milacre quadrat; (b) 10 or more seedlings 1 foot high to 1 inch d. b. h. per milacre quadrat.

saplings, and, in some instances, poles were counted if they fell within 1, 2, or 4-milacre circular plots, as specified in the table by the distances 3.7, 5.3, and 7.4 feet, respectively, from the point. Larger trees were counted if they fell within the specified distance from the point as shown for each d. b. h. class in the table.

TABLE 110.—*Effective seeding distance for individual seed trees and green timber edges, by species, forest type group or type, Northern Rocky Mountain Region*

Species of seed tree or forest type group at timber edge	Seed trees		Timber edges—maximum distance from point in multiples of average height of dominant and codominant trees
	Diameter breast high	Maximum distance from point	
	Inches	*Feet*	
Western white pine	16 and larger	50	2
Ponderosa pine	12–16	40	2
	18–24	50	
	26 and larger	70	
Douglas-fir	10–14	50	2
	16 and larger	60	
Grand fir	16 and larger	50	2
Western larch	14–18	50	3
	18 and larger	60	
Spruce	18 and larger	60	3
Cedar	16 and larger	130	4
Lodgepole pine	10 and larger	[1] 40	(1)
Aspen		[2] 30	

[1] When examining points for prospective stocking, ordinarily no allowance was made for standing individual lodgepole pine trees. The seed source was considered adequate only if cone-bearing slash less than 5 years old was present on ground at the point, or if the point lay within 2 chains of a standing body of green timber. In western Montana and north Idaho, scattered seed trees were considered only when full-crowned, vigorous, and windfirm, and within the distance from the point shown in the table.

[2] 2 chains; this distance refers to the stump of a recently cut tree. Major reliance for reproduction in aspen is placed on root suckers—not seed.

The following tabulation relates the entries in table 109 for seedlings and saplings to conventional measures by the stocked-quadrat method:

Entries from table 109		
Minimum trees per acre (number)	*Maximum distance from point (feet)*	*Equivalent minimum of trees per quadrat required for a stocked point (number)*
1,000	3. 7	1 per 1-milacre quadrat
1,000	5. 3	2 per 2-milacre quadrat
500	5. 3	1 per 2-milacre quadrat
250	7. 4	1 per 4-milacre quadrat

PROSPECTIVE STOCKING

Seed sources available and seedbed condition existing at unstocked sample points were carefully observed. If both seed source and seedbed were found adequate by the following standards, the point was classed as "stocking in prospect." If either seed source or seedbed, or both, were judged inadequate, the point was classed as "no stocking in prospect."

Table 110 shows the standards used for determining the adequacy of the seed supply. A seedbed was considered adequate only where 50 percent or more of the surface area of the quadrat surrounding the sample point was free of limiting cover such as rock, grass, shrubs, and if the point did not fall on permanent road surfaces, rock or water, etc. For the spruce type in south Idaho and Wyoming west of the Continental Divide, 1- and 2-milacre quadrats were used for this determination. With this exception, 4-milacre quadrats were used in all types and localities for determination of seedbed condition.

Examiners were instructed to observe the effects of deer browsing, particularly in the ponderosa pine type, and to record instances where it was believed to be serious. In north Idaho and Montana, when points fell in areas of very heavy deer browsing they were not considered for prospective stocking unless the point happened to fall in a location protected from the deer. Examiners were likewise instructed to observe signs of unusual rodent activities which might affect availability of seed for germination.

Prospects of stocking by Douglas-fir, larch, and lodgepole pine were not considered at points that fell within the prescribed effective seeding radius if the seed trees were infected with mistletoe.

EFFECT OF FELLING AGE

Whenever clear cuttings were encountered in stands below rotation age, appropriate adjustment factors were recorded. Rotation age and adjustment factors were used depending upon whether the owner was producing cordwood products or sawtimber (table 111).

TABLE 111.—*Percentage of mean annual growth at culmination attained at various ages, by forest type group and subregion, Northern Rocky Mountain Region*

Age (years)	Ponderosa pine, larch, and Douglas-fir					Western white pine, sawtimber	Lodgepole pine					
	Northern Idaho and Montana		Southern Idaho and Wyoming west of Divide	Wyoming, east of Continental Divide			Low elevations, western Montana and northern Idaho		High elevations, northern Idaho and Montana		Wyoming, east of Continental Divide	
	Sawtimber	Cordwood	Sawtimber	Sawtimber	Cordwood		Sawtimber	Cordwood	Sawtimber	Cordwood	Sawtimber	Cordwood
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
40	------	50	4	------	43	------	10	60	------	50	------	48
50	10	60	15	------	83	20	30	70	20	60	18	61
60	20	70	28	------	95	40	50	80	40	70	40	72
70	30	80	46	15	100	60	70	90	60	80	60	81
80	40	90	60	45	------	70	90	100	80	90	75	88
90	50	100	73	60	------	80	90	------	80	100	85	95
100	60	------	83	72	------	90	100	------	90	------	92	100
110	70	------	90	83	------	100	------	------	90	------	96	------
120	80	------	95	90	------	100	------	------	100	------	99	------
130	90	------	98	95	------	------	------	------	------	------	100	------
140	90	------	100	97	------	------	------	------	------	------	------	------
150	100	------	------	98	------	------	------	------	------	------	------	------
160	------	------	------	100	------	------	------	------	------	------	------	------

STANDARDS FOR THE SOUTHERN ROCKY MOUNTAIN REGION

Forest Type Groups

The following forest type groups and types were recognized:

Ponderosa pine	Hardwoods
Douglas-fir	Aspen type
Lodgepole pine	Elm-ash-cottonwood
Fir-spruce	Cottonwood type

Standards for the cottonwood type were the same as those described in the criteria for the Plains Region, p. 687.

Species Classification

In the examination of points, species desirability was determined according to the classification shown in table 112.

Existing Stocking

Table 113 shows by forest type group and geographic location the standards used to determine stocking at each point. Seedlings, saplings, and, in some instances, poles were counted if they fell within 1-, 2-, or 4-milacre plots as indicated in the table. Larger trees were counted if they were located within the maximum distance from the point indicated for each d. b. h. class. The following tabulation relates the entries in table 113 for seedlings, poles, and saplings to conventional measures by the stocked-quadrat method:

Entries from table 113		
Minimum trees per acre (number)	*Maximum distance from point (feet)*	*Equivalent minimum of trees per quadrat required for a stocked point (number)*
1,000	3. 7	1 per 1-milacre quadrat
1,000	5. 3	2 per 2-milacre quadrat
500	5. 3	1 per 2-milacre quadrat
250	7. 4	1 per 4-milacre quadrat

Prospective Stocking

The procedure followed in determining the prospects of future stocking at unstocked points in the Southern Rocky Mountain Region was similar to that for the Northern Rocky Mountain Region. The standards used for prospective stocking, based on proximity to seed source, were as follows:

Type group:	*Maximum distance of seed trees from point (feet)*
Ponderosa pine—Nevada, Utah, southwest Colorado, and east slope of Rockies:	
12 to 16 inches d. b. h.	40
18 to 24 inches d. b. h.	50
26 inches d. b. h. and larger	70
Arizona and New Mexico:	
18 inches d. b. h. and larger	50
Douglas-fir:	
10 to 14 inches d. b. h.	50
16 inches d. b. h. and larger	60
Hardwoods—aspen type	[1] 30

[1] This distance refers to the stump of a recently cut tree. Major reliance for reproduction in aspen is placed on root suckers, not seed.

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Type group:	*Maximum distance from point to timber edges in multiples of tree height*
Douglas-fir	2
Lodgepole pine	(1)
Fir-spruce	[2] 3

[1] Individual seed trees not considered as seed sources because of lack of windfirmness after cutting. The seed source was considered adequate only if cone-bearing slash less than 5 years old was present on the ground at the point or if a timber margin of cone-bearing trees was located within 2 chains of the point.

[2] Individual seed trees considered adequate seed sources only in occasional instances where windfirm after cutting. In Colorado where partial cutting removed less than 50 percent of the volume, seed sources were considered adequate. Maximum distance of 12-inch d. b. h. and larger seed trees from point in multiples of tree height, 1. Adjacent bodies of timber were considered adequate seed sources only when at least 60 years of age and judged to be windfirm.

The seedbed was considered adequate only where the 4-milacre plot surrounding a sample point was not more than 50 percent occupied by brush, grass, sod, weeds, rock, water, road surface, and other limiting cover. In Colorado, Arizona, and New Mexico it was further required that the plot be affected by logging through removal of trees, shrubs, and other vegetative competition or by scarification in order to qualify as an adequate seedbed.

In Utah and Nevada the examiner was especially instructed to observe site factors, inherent or introduced, which adversely affected the establishment of seedlings. Some of the factors to be considered were degree of slope, exposure, soil characteristics, browsing and/or trampling by grazing animals, and rodent damage. The decision with respect to the prospective stocking rating was based on the experience and judgment of the field examiner.

Effect of Felling Age

The factors shown in table 114 were used to determine the effect of felling age. Only a limited amount of cutting in second-growth stands occurs in the Southern Rocky Mountain Region. Therefore, table 114 presents data only for those type groups and localities where such cutting was expected to be encountered during field examination.

TABLE 112.—*Classification of species according to forest type group,[1] Southern Rocky Mountain Region*

Species	Ponderosa pine				Douglas-fir (Utah and Nevada)	Fir-spruce [2]		Lodgepole pine		Elm-ash-cottonwood (Colorado)
	Arizona and New Mexico [3]	Southwestern Colorado and east slope of Rocky Mountains	Western Nevada	Utah and Nevada (south)		Colorado [4]	Arizona and New Mexico [3]	Colorado [4]	Utah and Nevada	
Cottonwood										D
Douglas-fir	D	A	A	A	D		D		D	
Fir, alpine	A			A	[5] A	A	A	A	A	
Fir, grand	A		A		A		A		A	
Fir, red			[5] A							
Fir, white			[5] A	A	[5] A					
Incense-cedar			[5] A							
Larch			A		D				D	
Pine, lodgepole		A	A	A	A	D		D	D	
Pine, ponderosa	D	D	D	D	D				D	
Pine, Jeffrey			D							
Pine, sugar			D							
Pine, western white			A							
Spruce, blue	A	A			[5] A		A			
Spruce, Engelmann	A	A	A	A	D	D	D	D	D	

D = Desirable species.
A = Acceptable species.

[1] Aspen type: All species classed desirable.
[2] In Utah and Nevada: All species classed desirable if marketable locally except limber and whitebark pine, which are noncount species.
[3] All pines except pinyon were classified desirable for the type.
[4] All conifers not listed for the type were considered desirable.
[5] Classified acceptable only if marketable under local conditions; otherwise, as noncount.

TABLE 113.—*Minimum number of trees per acre and maximum distances from observation point used in classifying existing stocking, by forest type group and subregion, Southern Rocky Mountain Region*

Age or size of established seedling or sapling and crop tree d. b. h.	Ponderosa pine and Douglas-fir type groups (western Nevada)		Ponderosa pine type group (entire region except western Nevada)		Lodgepole pine type group [1] (entire region)		Hardwoods type group—aspen type (entire region)		Fir-spruce type group: Utah, Arizona, New Mexico, Colorado, south of Gunnison River		Fir-spruce type group: Colorado, north of Gunnison River		Fir-spruce type group: Western Nevada	
	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point	Trees per acre	Maximum distance from point
	Number	*Feet*	*Number*	*Feet*	*Number*	*Feet*	*Number*	*Feet*	*Number*	*Feet*	*Number*	*Feet*	*Number*	*Feet*
1 year to 6 in. high	1,000	5.3												
6 in. high to 4.5 in. d. b. h.	500	5.3												
1 year to 4.5 in. d. b. h.													1,000	3.7
4.6 in. d. b. h. to 8.5 in. d. b. h.	250	7.4												
4.6 in. d. b. h. to 9.5 in. d. b. h.													500	5.3
Seedling to 0.5 in. d.b.h							1,000	3.7						
Seedling to 1.0 in. d.b.h			500	5.3										
Seedling to 4 in. d. b. h.					1,000	3.7								
Seedling to 5 in. d. b. h.											1,000	3.7		
Seedling to 6 in. d. b. h.									500	5.3				
1 in. d. b. h.							900	3.9						
2							800	4.1						
2 and 3			250	7.4										
3							700	4.5						
4			218	8			600	4.8						
5			171	9	941	3.8	440	5.7						
6			139	10	653	4.6	360	6.2			560	5.0		
7			114	11	479	5.4	280	7.1						
8			104	12	367	6.2	230	7.7	280	7.1	315	6.6		
9	215	8.0	82	13	290	6.9	180	8.8						
10	174	8.9	70	14	235	7.7	150	9.6	180	8.8	202	8.3	278	7.0
12	121	10.7	62	15	163	9.2	110	11.2	125	10.6	141	10.0	194	8.5
14	89	12.5	48	17	120	10.8	80	13.2	92	12.4	103	11.6	143	9.9
16	68	14.3	38	19	92	12.3	60	15.2	70	14.0	79	12.9	109	11.3
18	54	16.1	32	21	72	13.8	48	17.0	56	15.8	62	15.0	86	12.7
20	44	17.1	29	22	59	15.3			45	17.6	50	16.8	70	14.1
22	36	19.6	24	24					37	19.4	43	18.0	58	15.5
24	30	21.5	20	26					31	21.0	35	19.8	49	16.9
26	26	23.1	18	28					27	22.8	30	22.3	41	18.3
28	22	25.1	16	29					23	24.6	25	23.6	36	19.7
30	19	27.0	14	31					20	26.3	22	25.1	31	21.1
32	17	28.6	13	33					18	28.1	20	26.4	27	22.5
34	15	30.3	11.4	35					16	29.8	17	28.5	24	23.9
36	13	32.6	10.7	36					14	31.6	16	29.4	22	25.4
38	12	34.0	9.6	38					12	33				
40	11	35.5	8.7	40					11	35				
40–50	8	41.6												

[1] Overstocking was considered the equivalent of nonstocking under the following conditions: (a) 20 or more seedlings 4 inches to 12 inches high per milacre quadrat; (b) 10 or more trees 12 inches high to 1 inch d. b. h. per milacre quadrat.

TABLE 114.—*Percentage of mean annual growth at culmination attained at various ages, by forest type group and subregion, Southern Rocky Mountain Region*

Age (years)	Ponderosa pine				Lodgepole pine (Colorado) [1]	
	Utah and Nevada	South Colorado slope	West and east slope	Arizona and New Mexico		
	Sawtimber	Sawtimber	Cordwood	Sawtimber	Sawtimber	Cordwood
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
40	4		43			48
50	15		83	34	18	61
60	28		95	52	40	72
70	46	15	100	68	60	81
80	60	45		79	75	88
90	73	60		88	85	95
100	83	72		93	92	100
110	90	83		97	96	
120	95	90		99	99	
130	98	95		100	100	
140	100	97				
150		98				
160		100				

[1] Effect of felling age not considered elsewhere in the lodgepole pine type.

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March 14, 1958

I&E NO. 58-23
AIR MAIL TO WEST
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Regional Foresters
and Directors (also AL & TR)

Dear Sir:

This letter furnishes policy guidelines for free distribution and gives details of the distribution plan for Forest Resource Report No. 14, TIMBER RESOURCES FOR AMERICA'S FUTURE. Related to this are I&E circular letters Nos. 58-20 and 58-22.

Demands for free copies of FRR-14 will be heavy. A total of 10,000 copies were printed for free distribution by the Forest Service. Free distribution as outlined in this letter will require about 7,000 copies. Because this is an expensive and highly technical report, and because the supply is limited, some controls on free distribution must be employed.

Copies of the complete Report, FRR-14, TIMBER RESOURCES FOR AMERICA'S FUTURE, may be purchased at $7.00 per copy from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., on or after March 31. The complete Report was printed only in bound, buckram cover for both free and sale distribution.

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Regions and Stations should take steps to insure delivery of FRR-14 to field offices so they will be received on or shortly after March 31. We feel it very important that Supervisors, Rangers and Work Center Leaders have copies as soon after the public announcement as possible so that they will not be at a disadvantage in discussing the Report.

We realize that the initial bulk shipment of FRR-14 made to you direct from GPO will not, in all cases, meet your requirements. This may be especially true regarding Stations, as they have now been assigned responsibility for sending copies to College and University Presidents. Please appraise your additional needs in view of the distribution scheme attached and the number of copies already shipped you (shown on I&E No. 58-20). Then advise us, keeping in mind the need for limiting distribution to essential outlets. Also, advise us of any distribution problems where we may help.

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Very truly yours,

Clint Davis

CLINT DAVIS, Director
Division of Information & Education

Attachment

Note: We plan to send you additional copies of this letter on March 27 for distribution to Rangers and Work Center Leaders so that they will be aware of the complete scheme of distribution.

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(Forest Resource Report No. 14)

March 30, 1958

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Forest Products Industries, American
Forest Industries Council
Furniture Manufacturers, National Assn. of
Grange, National
Hardwood Wholesalers, National Assn. of
Hardwood Lumber Assn., National
Home Builders, National Assn. of
Industrial Development Council, American
Industrial Council, National
Lumber Assn., National American Wholesale
Lumber Assn., National Hardwood
Lumber Exporters Assn., National
Lumber Manufacturers Assn., National
Lumber Dealers Assn., National Retail
Lumber Distributing Yard Assn., National
  Wholesale
Manufacturers, National Assn. of
Mining Congress, American (Land and Water Use
  Committee)
Newspaper Publishers Assn., American
Newsprint Service Bureau
Nurserymen, American Assn. of
Paper & Pulp Assn., American
Publishers Assn., Agricultural
Pulpwood Assn., American
Railroads, Assn. of American
Wood Preservers Assn., American
Wooden Box Assn., National
Woodwork Manufacturers Assn., National

11. <u>National Headquarters of Conservation and Agricultural Organizations</u> - Copy to be furnished by personal letter same as Industry group above, to following organizations: 200

American Foresters, Society of
American Resource Management, Foundation for
Audubon Society, National
Charles Lathrop Pack Forestry Foundation
Citizens Committee on Natural Resources

Estimated no.
<u>copies required</u>:

Citizens for Conservation, Inc.
Conservation and Research Foundation, Inc.
Conservation Education Assn., Inc.
Conservation Foundation
Daughters of the American Revolution
Emergency Conservation Committee
Ford Foundation
Forest Conservation Society of America
Forest History Foundation, Inc.
Forest Products Research Society
Forestry Assn., American
Friends of the Land
Game, Fish & Conservation Commissioners,
International Assn. of
Garden Club of America
Geographical Society, American
Glassland Research Foundation
Izaak Walton League of America
National Affairs, Bureau of
Nature Assn., American
Nature Conservancy
Nature Study Society, American
Natural Resources Council of America
Outdoor Writers Assn. of America, Inc.
Park Executives, American Institute of
Parks Assn., National
Planning and Civic Assn., American
Public Administration, Institute of
Range Management, American Society of
Reclamation Assn., National
Recreation Assn., National
Resources for the Future, Inc.
Rockefeller Foundation
Soil Conservation Districts, National Assn. of
Soil Conservation Society of America
Sport Fishing Institute
State Garden Clubs, Inc., National Council of
Tree Assn., American
Twentieth Century Fund
Watershed Council, Inc., American
Wilderness Society
Wildlife Federation, National
Wildlife Foundation, North American
Wildlife Management Institute
Wildlife Society
Women's Clubs, General Federation of
Women Voters of the U. S., League of

12. <u>Automatic Mailing Lists Handled Direct by Government Printing Office and Department of Agriculture</u> - The following mailings will not be accompanied by letter: 950

Forestry School Libraries
WO Extension Foresters Sowder and Williams (receive 40 copies each for distribution to Extension Foresters)
Libraries of State Agricultural Colleges
State Agricultural Experiment Station Libraries
Principal libraries
Libraries with special interest in FS publications
Agricultural Commissioners of State Departments of Agriculture
Embassies and Legations in Washington, D. C.
Foreign -- Exchange libraries, Government forestry officials, and libraries of institutions and schools teaching forestry

REGIONAL FORESTER DISTRIBUTION

1. State Governors

   Consider sending copy with personal letter from RF to each Governor, advising that the Report has also been sent State Forester and Commissioner of Agriculture. Also offer additional copies, on request, to Executive Office of the Governor if needed.

2. State Extension Directors

   We suggest sending copy with personal letter from RF to Director offering copies for Staff as needed and requested. There will be some duplication here with the 80 copies automatically furnished WO Extension Service for Extension Foresters, but we feel personal contact by RF important.

3. Regional Advisory Councils

   We suggest copy with personal letter from RF.

4. Regional and State Organizations

   We suggest copy with personal letter from RF to such organizations as:

   Federation of Western Outdoor Clubs
   Forest Farmers Assn., Cooperative
   Sierra Club
   Western Forestry and Conservation Assn.
   Western Pine Assn.
   Southern Pine Assn.
   Trees for Tomorrow, Inc.
   State Forestry Assns.
   etc.

5. Key Individuals Not Included Above

   We suggest copy with personal letter from RF or others.

6. <u>In-Service</u>

Your supplies for in-Service distribution have been allocated on the basis of 10 per Regional Office, 2 each Supervisors headquarters, and 1 to each Ranger District office.

STATION DIRECTOR DISTRIBUTION

1. <u>Station Advisory Councils</u>

Suggest sending copy with personal letter signed by Director.

2. <u>State Experiment Station Directors</u>

Suggest copy with personal letter from Director indicating that State Experiment Station Library is also being furnished a copy direct from the Government Printing Office.

3. <u>All Land-Grant Colleges and Other Selected Institutions of Higher Education</u>

Suggest copy with personal letter from Director to Presidents of Land-Grant Colleges and other selected colleges and universities. Letter should state, where applicable, that copy has been furnished direct to Dean and library of Forestry School and to State Agricultural College Library, and that additional copies will be furnished on request for schools dealing with Economics, Public Affairs, Natural Resources, and related subjects. (Resulting requests for additional copies may be referred to WO I&E for direct mailing.)

4. <u>Key State and Federal Research People Not Included Above</u>

Suggest copy with personal letter from Director or others.

5. <u>In-Service</u>

Your supplies for in-Service distribution have been allocated on the basis of 10 copies per Station headquarters and 1 copy to each Work Center.

FORESTS OF THE


UNITED STATES